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ABSTRACT

This newsletter contains items of interest to anyone concerned with science and society interactions. The first section of this issue contains 19 news and communication items including program descriptions and reports on workshops, meetings, and seminars. Five feature articles are also included, the titles of which are: (1) Revelation and Heresy in Sociobiology: A Review Essay; (2) Public Involvement in the DNA Controversy: The Case of Cambridge, Massachusetts; (3) Present Strains in the Relations Between Science, Technology and Society; (4) On a Strategy for Using the Electronic Media to Improve the Public Understanding of Science and Technology; and (5) Commentary: Science on Japanese Television, An Adaptable Model for the U.S. (BB)

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SPRING 1979 ISSUE NO. 27

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SCIENCE, TECHNOLOGY, & HUMAN VALUES

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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) AND USERS OF THE ERIC SYSTEM."

AN INTERDISCIPLINARY QUARTERLY REVIEW

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Revelation and Heresy in Sociobiology,
by Alexander J. Morin

Public Involvement in the DNA Controversy,
by Rae S. Goodell

Present Strains in the Relations Between Science, Technology, and Society,
by Steven Louis Goldman

On a Strategy for Using the Electronic Media
to Improve the Public Understanding of Science and Technology,
by Jeffrey W. Kirsch

and featuring:
A Report on the Activities of the AAAS Committee
on Scientific Freedom and Responsibility

and
A Comparison of Science on Public Television in the U.S. and Japan

with: News Items, General Bibliography, and Meetings Calendar

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SCIENCE, TECHNOLOGY, & HUMAN VALUES

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News Items

A. Workshop on Human Rights and Public Policy, June 1979

Increasing public discussion, media attention, and Congressional scrutiny have prompted re-evaluation of the human rights components of issues such as welfare, abortion and nuclear power, as well as government foreign policy. As the debate intensifies and more conflicts arise over what are or are not human rights, the need for systematic examination of the ethical questions pertaining to human rights becomes all the more pressing. On 17-23 June 1979, The Center for Philosophy and Public Policy (University of Maryland) and The Hastings Center will sponsor a "Human Rights and Public Policy" Workshop at St. John's College, Annapolis, MD. Specific topics will include: whether there is a right to income and, if so, how it might interact with work requirements; human rights considerations that arise in the conduct of foreign policy; issues of abortion and the "legacy" of long-term nuclear waste disposal as it relates to obligations to future generations; and the nature of ethical reasoning in applied contexts. The workshop format will feature formal presentations and discussion seminars. General workshop fee is $240, exclusive of room and board. Direct inquiries to Dr. Peter G. Brown, Director, Center for Philosophy and Public Policy, University of Maryland, College Park, MD 20742.

B. HEW Ethics Advisory Board Announces Publication of Transcripts

At the regularly scheduled meetings of the Ethics Advisory Board of the Department of Health, Education, and Welfare, a wide variety of topics are discussed, and expert consultants frequently present papers prepared at the request of the Board. This Spring, the Board has begun publication of the transcripts of these meetings and the public hearings held nationwide in Fall 1978. The initial publication group is:

- Board Meeting (15-16 September 1978), Bethesda, MD, Publication Number PB288764/AS, $11.75;
- Public Hearing and Board Meeting (13-14 October 1978), Boston, MA, Publ. No. PB288765/AS, $13.25;
- Public Hearing and Board Meeting (9-11 November 1978), Seattle, WA, Publ. No. PB288405/AS, $14.00;
- Public Hearing (14 November 1978), San Francisco, CA, Publ. No. PB288766/AS, $9.25;
- Public Hearings (1 and 5 December 1978), Atlanta, GA, and Detroit, MI, Publ. No. PB289593/AS, $7.25;
- Public Hearing (6 December 1978), Philadelphia, PA, Publ. No. PB289808/AS, $9.50;
- Public Hearing (8 December 1978), Denver, CO, Publ. No. PB289590/AS, $7.25;
- Public Hearing (11 December 1979), Dallas, TX, Publ. No. PB290635/AS, $7.25.

The Board will also publish the remaining transcripts of its meetings and public hearings. Documents should be ordered through the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161.

C. Proposed Legislation and Two New Associations Signal Increased Efforts to Promote Participation of Women in Science and Mathematics

On 7 March 1979 Senator Edward Kennedy (D-Mass) introduced the "Women in Science and Technology Equal Opportunity Act" (S. 568), which would establish a 10-year, $250 million program to apply the resources and leverage of the National Science Foundation, as lead agency, and the Federal Government to the achievement of equal opportunity in science. This legislation incorporates discussion resulting from last year's hearings on S. 2550 (a similar bill also sponsored by Kennedy) and the comments of over 400 individuals and organizations who reviewed it.

The newly proposed legislation includes the following provisions:

a) Funding at the elementary, secondary and college levels to encourage women to pursue courses in science and math.

b) Research and information programs to help women enter scientific careers. These would include a Clearinghouse on Women in Science, operated by the NSF, with $3 million allocated for FY1980 and for each of the nine succeeding fiscal years.

c) Programs to increase public awareness of the importance of full participation of women in the scientific and technical workforce.

d) Incentives for individuals and institutions which demonstrate a record of achievement in encouraging women to study science and math and in providing employment opportunities for women.

e) Establishment of a President's Committee for Equal Opportunity in Science Awards. This 13-member Committee will recommend to the President names of recipients of a Distinguished Achievement in the Advancement of Women in Science Award (not more than twenty cash awards of $25,000 each), and recommend to the NSF Director candidates for the Mathematics and Science Incentive Award (not more than twenty cash awards of $10,000 each).

f) Reporting procedures to measure program effectiveness and to help identify problem areas, based on a data collection program at the NSF.

g) Enforcement provisions to assure full compliance with all requirements relating to equal opportunity for women in science, including a complex formula to reduce indirect costs of institutions not in compliance.

Hearings on the Women in Science bill have been tentatively scheduled for early April and will be conducted by the Health and Scientific Research Subcommittee of the Senate Labor and Human Resources Committee.

* * *

Two new organizations also demonstrate the continued concern within the scientific community that women are not full participants in the nation's scientific enterprise, whether in general science and mathematics educational opportunities, in specialized science education, or in careers in research or industry. For example, The Association for Women in Computing (AWC) was recently formed to promote communication among women working in computer science and to further their professional development. AWC will also promote the education of women and girls in computer science.

Membership is open to all interested persons. For more information, write Anita Cochran, 5A137 Bell Laboratories, Murray Hill, NJ 07974.

At the 1978 Annual Meeting of the National Council of Teachers of Mathematics, this concern was also demonstrated by formation of The Association for the Promotion of the Mathematics Education of Girls and Women (APMEG&W). The aim of this association is "to reverse the trend of avoidance of mathematics among female students in elementary and secondary [schools]." To join, write APMEG&W, c/o Education Department, George Mason University, 4400 University Drive, Fairfax, VA 22030.

D. FY1979 First Quarter Grants from NSF EVIST Program

In the following list of FY1979 First Quarter grants by the NSF Ethics and Values in Science and Technology Program, two-thirds of the grants are jointly supported by NSF and the National Endowment for the Humanities. In a 2 March 1979 statement before the Subcommittee on Health and Scientific Research, Senate Committee on Human Resources, NSF Director Richard C. Atkinson affirmed the Foundation's interest in such cooperative efforts in this field:

> In another area of mutual interest to this Committee and the Foundation progress continues in the Ethics and Values in Science and Technology Program. Joint review and funding arrangements with the National Endowment for the Humanities have proved successful. In fiscal year 1978 nine awards were jointly funded with NEH. It appears now that the level of joint funding will be even higher in FY1979 and FY1980, since NEH is increasing emphases on programs dealing with ethical and values issues associated with science and technology. We have also proposed to the National Institutes of Health the establishment of a joint program along the lines of the arrangement successfully developed with the National Endowment for the Humanities. We look forward to cooperation with NIH.

The NSF EVIST awards announced to date are:

* Science and Ethical Responsibility: A National Workshop for Undergraduate and Graduate Students (Principal Investigator: Sanford A. Lakoff, Department of Political Science, University of California-San Diego, La Jolla, CA 92093), 18 months starting 15 November 1978, jointly supported by NSF and NEH. A national workshop 19-26 June 1979 will aim to sensitize outstanding students in science, engineering and the humanities to significant ethical issues associated with science and technology, and to provide an opportunity for them to explore those issues in association with distinguished scientists and humanists. The project will bring together advanced undergraduate and graduate students from throughout the country for a week-long conference on Science and Ethical Responsibility. Students (drawn from the natural sciences and engineering and from the social sciences and humanities) will be selected on basis of essays on specific ethical issues associated

with the conduct and applications of science. Faculty and guest lecturers include scientists, engineers and humanists, many of whom have been associated with the International Pugwash Conferences. Following the conference, participants will rewrite their essays in the light of the conference discussions. The best of these will be published in a volume to be disseminated to college and university programs on science and society and to other interested individuals or groups.

* Ethical Issues in Research on Human Reproduction: A National Workshop (Principal Investigator: Helen Holmes, Federation of Organizations for Professional Women, 2000 P Street, N.W., Washington, DC 20037), 22 months starting 1 December 1978, jointly supported by the NSF and NEH. This project will explore ethical issues associated with the determination of priorities for human reproduction research and for applications of that research. The goal will be to determine if any basis exists for allegations that these priorities have been biased by insufficient opportunities for women to participate in discussions on priorities. The issues will be addressed at a five-day workshop in Summer 1979, during which scholars and lay persons from biology, ethics, medicine, law, sociology, philosophy, social work, history, and other fields will attempt to determine whether the policy debate in these areas can be broadened substantially by fuller participation by women.

* The Influence of the Values of Behavioral Scientists on Research and on American Society, 1945-76 (Principal Investigator: Leonard Krasner, Psychology Department, State University of New York, Stony Brook, NY 11790), 24 months starting 1 February 1979, jointly supported by the NSF and NEH. Although this project will be specifically concerned with the relationships between ethical and value systems implicitly and explicitly espoused by leading behavior modification scientists, the analytical, philosophical framework to be developed will also be applicable to other scientific disciplines. A primary objective of the project is to stimulate informed debates both within the behavior modification community and among the concerned public about the issues of concern, and toward that end, the project will sponsor a series of presentations at professional meetings of behaviorists and applied philosophers, and a book aimed at the general public.

* Ethical and Value Dimensions of the Nuclear Power Debate (Co-Principal Investigators: Robert C. Mitchell, Resources for the Future, Washington, DC 20036; and Dorothy Nelkin, Program on Science, Technology and Society, Cornell University, Ithaca, NY 14853), 24 months starting 15 March 1979. The current debate about the implementation of nuclear technologies as energy sources has become a serious political matter in the U.S. and other industrialized countries. Existence of the anti-nuclear movement, in particular, raises significant questions about how and by whom decisions related to the conduct and application of science and technology should be made. During the course of debate, many important ethical questions have emerged, including responsibilities to future generations; means for determining acceptable levels of scientific risk; equitable distributions of risks and benefits; and appropriate roles for scientific and technical experts in political controversies. This project will analyze the U.S. nuclear debate as a social movement, focusing attention on the degree to which these ethical issues have affected the ideologies of groups on both sides of the issue. Have

the nuclear opponents' public protest activities helped to clarify or served to obscure underlying ethical issues for the general public? Analysis of relevant documents and survey data, and in-depth interviews with leaders of the U.S. pro- and anti-nuclear movements will result in a major monograph accessible to the general public and articles and papers prepared for publication in the professional and popular literature.

* Drugs as Medical Technology: Ethical Issues in the Treatment of Borderline Hypertension (Principal Investigator: Sally Guttmacher, Columbia University, New York, NY 10032), 12 months starting 1 May 1979. Although chemical intervention is increasingly part of the normal course of medical treatment, the personal and social consequences of the treatment regimen have not always been adequately investigated, nor have the values implicit in chemical intervention been adequately examined. This project will examine ethical issues raised by specific cases of chemical control of a somewhat ambiguous medical condition, borderline hypertension, which has generated considerable debate on the costs and benefits of various treatment modes. The fact that the proportion of borderline hypertensives among the black population in the United States is three times that of the general population raises issues of special significance concerning the definition, diagnosis and treatment of the disorder. Through interviews, workshops and a continuing interdisciplinary seminar, the project will examine such issues as: value assumptions underlying the evolving medical conception of borderline hypertension; the appropriateness of differing conceptions of health in assessing treatment alternatives; strategies for assessing risks and benefits of alternative treatments; and possible differences in diagnosis and treatment depending on the patient and on the institutional setting.

* Ethical and Value Issues in Natural Resource Development (Principal Investigator: Raymond Gold, University of Montana, Missoula, MT 59801), 24 months starting 1 June 1979, jointly supported by the NSF and the NEH. Increasing world-wide demand for energy resources has prompted the U.S. to begin tapping its "economically strippable" coal, much of which lies under sparsely populated areas of the Rocky Mountain West. Introduction of large scale, new technologies into rural Western communities raises ethical issues such as: by what mechanisms and by whom should decisions about technological interventions be made? how can interventions be equitable and minimally disruptive to the value systems of rural people? and how should local social costs and benefits of technological progress be weighed against regional and national costs and benefits? This project aims to delineate and analyze the ethical issues and value conflicts that have resulted from the introduction of new technologies into the Rocky Mountain West and to develop and test an accomodation approach to conflict resolution in this case. An in-depth case study of a single rural community that will be experiencing technology-related growth and change during the course of the study will provide information that will be disseminated to the public, policy makers, and scholars. A technical advisory committee and a local citizens' advisory committee will guide, assist and monitor the project.

E. Humanities Association Sets Ambitious Agenda

After more than two years of planning, a new organization--the American Association for the Advancement of the Humanities (AAAH)--began a full program of activities in January 1979 by opening an office in Washington, DC, launching a membership drive, and beginning regular publication of a monthly newsletter, Humanities Report. The idea of forming a group to strengthen and advance the humanities came from James M. Banner, Jr., chairman of the AAAH Board and Editor of its newsletter. According to an account of the association's origins (by co-founder Theodore Rabb), "The immediate stimulus was the crisis over the chairmanship of the National Endowment for the Humanities in 1976 and 1977. . . .What troubled Banner and others was that the politics of the appointment were obscured from public view and that individual humanists, whom the outcome would most affect, possessed few means to influence it."[1]

The AAAH has set an ambitious agenda. In addition to publishing Humanities Report, it plans to represent the humanities before governmental agencies and other institutions; sponsor conferences, research projects, and reports to explore major issues facing the humanities, and establish better links with the press and with appropriate groups in medicine, science, industry, and the law.

The first issue of Humanities Report (January 1979) is professional-looking and crisply written. In "A Statement of Purpose," Editor Banner writes:

> "The Humanities Report will make available to its readers news about the intellectual condition, the institutional, political, and professional circumstances, and the public dimensions of the humanities. Its reportage will be factual and comprehensive. Its style will be direct, its point of view neutral, its tone candid."[2]

And he is keenly aware of the obstacles:

> "There is little reason to minimize the difficulties involved in launching this publication. Humanists cannot draw on a tradition of vigorous and informed humanities journalism; coverage of the humanities. . .is virtually nonexistent in the public press. Moreover, humanists are not accustomed as professionals to address issues that embrace the humanities generally. And although they are no strangers to politics, they have rarely been comfortable acknowledging and participating in the politics of the humanities. . .even when politics deeply and increasingly influence their work and interests."[3]

Articles on a proposed White House conference on the humanities, a new Humanities Commission sponsored by the Rockefeller Foundation, and the peer review process in the NEH, round out the first issue of the Report. The $25 dues of the AAAH include a subscription. American Association for the Advancement of the Humanities, 918 16th Street N.W., Suite 601, Washington, DC 20006.

NOTES

1. Theodore K. Rabb, "The Origins of the AAAH: A Brief Account," 1 Humanities Report (January 1979): 13.
2. James M. Banner, Jr., "A Statement of Purpose," 1 Humanities Report (January 1979): 1.
3. Ibid., p.2.

F. Symposium: Genetics and the Law, May 1979

The American Society of Law and Medicine, and the Eunice Kennedy Shriver Center are co-sponsors of a national symposium "Genetics and the Law" that will be held in Boston, MA, 21-23 May 1979. Highlights of the program include:

Monday, May 21

Morning session on "Government Control of Science," moderator--Charles Fried; participants--Bernard D. Davis, DeWitt Stetten, Jr., Daniel Callahan, John A. Robertson, Seymour Lederberg, and Stanley J. Reiser.

Afternoon session: "Genetic Counseling and Screening," moderator--Margery W. Shaw; participants--Aubrey Milunsky, Joseph M. Healey, Alexander M. Capron, Y. Edward Hsia, Jay Katz, and Joseph F. Fletcher.

Tuesday, May 22

Morning session: "Ethics, Eugenics, Law and Society," moderator--Mary Ellen Avery; participants--Charles H. Baron, Arnold S. Relman, Robert A. Burt, Robert M. Veatch, John C. Fletcher, and Leonard H. Glantz.

Afternoon session: "Law and the Control of Genetic Disease," moderator--Aubrey Milunsky; participants--Margery W. Shaw, Arno G. Motulsky, Neil A. Holtzman, Judith P. Swazey, James R. Sorenson, Gilbert S. Omenn, and Peter V. Tishler.

Wednesday, May 23

Morning session: "Genetics and Family Law," moderator--Sanford N. Katz; participants--Barton Childs, Paul R. Friedman, Nancy S. Wexler, George J. Annas, Melvin L. Taymor, and Barbara F. Katz.

Afternoon session: "Genetics, Law and Environmental Mutagens/Teratogens," moderator--George J. Annas; participants--Arthur D. Bloom, Catherine J. Damme, Richard B. Stewart, Donald F. Hornig, Nicholas A. Ashford, and Gregory T. Halbert.

The conference will be held at the Copley Plaza Hotel in Boston. Registration is limited, but student rates are available. A detailed program and registration form may be obtained from: American Society of Law and Medicine, 454 Brookline Avenue, Boston, MA 02215.

G. Workshop on Ethical Issues in Human Reproduction Technology, June 1979

The Federation of Organizations for Professional Women will sponsor a workshop 24-29 June 1979 at Hampshire College, Amherst, MA, that will focus on "Ethical Issues in Human Reproduction Technology: Analysis by Women." The project aims to explore the effects of introducing more direct input by women into public and policy debates on the setting of research priorities and the use of reproductive technologies. Workshop topics have been divided into: 1) Ethical Dimensions of Contraceptive and Abortion Technologies; 2) Perinatal Ethical Issues; and 3) Engineering of Human Reproduction. Participants will be selected from professionals and concerned lay persons. Applicants from a wide range of disciplines and points of view are encouraged to apply to the project directors, Helen B. Holmes, Judith A. Ramaley, and Janice G. Raymond. For further information: EIRTAW, P.O. Box 1022, Amherst, MA 01002; (413) 253-2063.

H. Workshops on Ethical Issues in Engineering, July 1979

"Workshops on Ethical Issues in Engineering," a two-week institute for philosophy and engineering educators, will be presented by the Center for the Study of Ethics in the Professions, Illinois Institute of Technology, Chicago, 16-27 July 1979. The NSF-NEH supported workshops will provide opportunities for philosophy and engineering educators to exchange ideas on courses on ethics and professional responsibility of engineers. Subject matter and cases will concern the situation of the professional, ethical problems confronting engineers, strategies for resolution of problems, and roles and responsibilities of engineering societies, government, and the individual. Workshop staff includes philosophy and engineering faculty of Illinois Institute of Technology and visiting lecturers. Participants will receive travel funds and a stipend. For more details, write: Vivien Weil, Center for the Study of Ethics in the Professions, Illinois Institute of Technology, Chicago, IL 60616.

I. Hastings Institute Summer Workshop: Bioethics and Public Policy, July 1979

"Bioethics and Public Policy" is the theme of a 1979 summer workshop, sponsored by The Hastings Center, which will be held at the University of Colorado, Boulder, CO, 15-22 July. Opening sessions will focus on health policy alternatives, national health insurance, the current cost containment effort, and health planning techniques. Other topics on the agenda include public policy issues related to abortion (including Medicaid funding of abortion), death and dying, involuntary commitment, policies on homosexuality, the ethics of behavior control, and the policy dimensions of human genetics. The workshop will also examine the work of the National Commission for the Protection of Human Subjects and evolving ethical and legal positions on informed consent.

The workshop is designed for college teachers, medical and law school faculty, medical professionals, the clergy, and others interested in the social and ethical issues of health policy. John C. Fletcher (NIH) is the workshop director. Staff include: Ronald Bayer (The Hastings Center); Charles Culver

(Dartmouth Medical School); Patricia King (Georgetown University Law Center); and Bruce Miller (Department of Philosophy, Michigan State University). Guest lecturers include: Stanley B. Jones (Institute of Medicine); Melvin Levine (Children's Hospital Medical Center, Harvard University); Gilbert Omenn (Office of Science and Technology Policy, The White House); and Daniel Callahan, Willard Gaylin, and Robert Veatch (all of The Hastings Center).

Workshop fee is $230, plus room and board. For information, write: Robert M. Veatch, Senior Associate, The Hastings Center, 360 Broadway, Hastings-on-Hudson, NY 10706, or phone (914) 478-0500.

J. One-Day Seminar on Innovations in Teaching Science Communication, August 1979

The Science Writing Educators Group of the Association for Education in Journalism (AEJ) will present a day-long seminar on teaching science communication, Sunday, 5 August 1979, as a pre-meeting session of the AEJ annual meeting at the University of Houston (TX). The preliminary program includes sessions on:

1) "Teaching Science Communication: What Works for Me"--The session will include an open paper competition with brief summaries by the winners and in-depth group discussions between the winners and the audience about the papers.

2) "Preparing Students for the Real World of Science Communication--Practitioners Advise Us"--A panel discussion by a medical school or university public information officer, a National Aeronautics and Space Administration public relations officer, newspaper science writers, a science writer from a trade journal or magazine, and a scientist. Science writing educators will respond to panel suggestions and open discussion follows.

The seminar is co-sponsored by the AEJ Divisions for Mass Communications and Society, Theory and Methodology, and Public Relations. For further information, contact Sharon Friedman, Journalism Division UC #29, Lehigh University, Bethlehem, PA 18015; (215) 691-7000, extension 337.

K. International Conference on Social Science and Medicine, August 1979

The Sixth International Conference on Social Science and Medicine will be held at The Leeuwenhorst Congress Center, Amsterdam, The Netherlands, 5-10 August 1979. Main themes will be:

A. Organization of Health Care in their Social and Political Contexts, including sessions on "Primary Health Care in the Third World," "Comparative Occupational Roles in Health Care," "The Relationship Between Systems and Goals in Health Care," and "Comparative Systems of Health Care."

B. Decision Making in Health Policy, including sessions on "The Role of the Public/Consumer in Health Policy," "The Effects of Professional Dominance on Health Care Decisions," "Issues in the Establishment of Priorities in Resource Allocation," "Attempts to Control the Costs of Health Care," and "Relationships Between Medical and Social Policy."

C. Intervention Strategies and Health Outcome Measures, including sessions on "Intervention Strategies and Health Outcome Measures and Life Style Behaviour Patterns," "Intervention Strategies and Health Outcome Measures: the Case of Nutrition," "Intervention Strategies and Health Outcome Measures: Methodological Issues," "Intervention Strategies and Health Outcome Measures: Family and Community Support Policies," "Ethical Issues in Human Experimentation," and "The Ethnography of Lay and Medical Behaviour."

Preliminary programs and further information may be obtained from: Dr. P.J.M. McEwan, Glengarden, Ballater, Aberdeenshire AB3 5UB, SCOTLAND.

L. Call for Papers: Conference on Business and Professional Ethics, November 1979

The Departments of Philosophy of Kalamazoo College and Western Michigan University are jointly sponsoring a Conference on Business and Professional Ethics, to be held 1-3 November 1979, in Kalamazoo, MI. The conference organizers are soliciting papers on any areas of business and professional ethics, particularly macro-ethical issues (e.g., in regard to business relations between those in different types of economic systems), the issue of whether there should be codes of ethics in business and the professions, and the question of whether professionals and those in business are exempt from some of the constraints of ordinary morality. Papers should be comprehensible to a general audience of university-educated persons and will be selected on the basis of competence, intelligibility, and relation to other conference sessions. Papers will be limited to 20-30 minutes reading time, and should be submitted in publishable form, insofar as this is possible. Some grants for accommodations, travel, and honoraria may be made. Send papers, in triplicate, with an abstract, by 1 July 1979, to: Conference on Business and Professional Ethics, Department of Philosophy, Western Michigan University, Kalamazoo, MI 49008. For further information, contact Professor Michael S. Pritchard, Department of Philosophy, Western Michigan University; (616) 383-1657.

M. OTA Congressional Fellowship Program for 1979-80.

The Office of Technology Assessment (OTA) Congressional Fellowship Program provides an opportunity for individuals who have demonstrated outstanding ability in management or research to gain a better understanding of science and technology issues facing the Congress and the way in which the Congress establishes national policy related to these issues. The program allows Fellows to participate in the policy research and analysis program of OTA, an advisory arm of Congress that helps legislative policymakers anticipate and plan for the consequences of technological changes and examines the ways in which technology affects human life. Assessments are currently being conducted in the areas of energy, materials, world trade, national security, health and life sciences, food and agriculture, research and development, information systems, oceans, and transportation.

The program is open to persons trained in all disciplines of science and technology and related policy or research activities, including (but not limited to) physical and biological sciences, engineering, law, economics, environmental and social sciences, and public policy. For 1979-80, six

Fellows will be selected. The fellowship period covers 1 year beginning in September 1979, and requires residence in metropolitan Washington, DC.

Applicants must be able to perform objective, even-handed analyses; to work cooperatively with individuals of diverse backgrounds, experience, and training; and to present reports in clear, concise language, and will be considered on the basis of their achievements, their potential for contributing to OTA's congressional work and their potential for professional growth. Candidates must have completed research and training at the doctoral level, or have equivalent experience (as judged by the Selection Committee).

Applicants for the fellowships must submit: 1) a detailed resume listing area(s) of special interest, education and experience, publications, and names of three character references; 2) three letters of reference from individuals who know the applicant well enough professionally to describe his or her capability and ability to work creatively as a member of an interdisciplinary research team (these letters must be sent directly to the address below); 3) a statement of approximately 1000 words addressing the applicant's interest in the fellowship program and his or her career goals. Applications and letters of reference must be postmarked by 1 May 1979. Awards will be announced by 30 June 1979. Send applications and letters of reference to: Congressional Fellowships, Office of Technology Assessment, Congress of the United States, Washington, DC 20510.

N. Proceedings: New Zealand Symposium on Social Responsibility in Science

The January 1979 meeting of the Australia-New Zealand Association for the Advancement of Science (ANZAAS) included a three-day symposium on social responsibility in science at which papers on the following themes were presented: 1) Scientists as Citizens: The Issue of Involvement; 2) Research: Support the Structure or Restructure the System?; and 3) Silence in Science: The Dissemination of Knowledge. The symposium, sponsored by the New Zealand Association of Scientists (NZAS), included papers by George Borgstrom (Michigan State University), "The Responsibility of Science to Society"; Jarlath Ronayne (University of New South Wales), "Autonomy, Accountability and Responsibility in Science"; Mark Diesendorf (Society for Social Responsibility in Science, Australia), "Sounding the Alarms"; Lois Bryson (Monash University), "Is Scientific Value a Fiction?"; David Baragwanath (Auckland, New Zealand), "Freedom of Information: The Case for Openness"; and Ron Johnston (Department of Science in Canberra), "Structural Silence in the Conduct of Science".

NZAS distributed abstracts of the papers through a special issue of their publication, New Zealand Science Review. Symposium proceedings will be published in Summer 1979 as Focus on Social Responsibility in Science [price will be approximately $4.00 (New Zealand)]. For more information, write New Zealand Association of Scientists, P.O. Box 1874, Wellington, New Zealand.

O. Revised "NOVA" Schedule for 1979 Season

WGBH-TV, producers of the "NOVA" science series, recently announced a revision in the 1979 NOVA broadcast schedule. Early in the production year, a strike by WGBH film department employees prevented the completion of many of the 1979 season programs. Programs scheduled to air through April 5 were broadcast as originally listed, but from April 12 through July 26, the NOVA schedule will include outstanding shows from former seasons. A new season will premiere in October 1979 and run through June 1980.

The revised NOVA schedule for 1979 includes:

"Road to Happiness," Thursday, April 5--How much of the image of Henry Ford, the man whose Model T put America on wheels, is true? Through rare footage from the Ford Film Collection, NOVA tells the story of the shy, nearly illiterate farm boy who has become part of America's legendary past.

"Icarus' Children," Thursday, April 12--On 23 August 1977, a contraption made of aluminum tubes, styrofoam and piano wire lifted off from a California airfield with a cyclist at the controls, pedaling for all he was worth. The strange craft rose ten feet in the air and flew a figure-eight course. NOVA tells the story of the first and only winner of the Kremer Prize for man-powered aviation.

"Across the Silence Barrier," Thursday, April 19--NOVA explores the world of one million Americans who lack the ability to hear human speech and examines recent developments in understanding and treating deafness.

"A Desert Place," Thursday, April 26--On the Sonoran Desert of southern Arizona, the plants and animals have survived triumphantly. This NOVA also captures in rare detail a dramatic desert thunderstorm.

"Still Waters," Thursday, May 3--A year-long visit to central Massachusetts to examine the life and rhythm of a fresh water pond shows that seemingly still waters are the scene of constant drama.

"A Whisper from Space," Thursday, May 10--A whispering trace of energy left from the theoretical "big bang" billions of years ago may now be quietly telling us about the origins of the universe.

"The New Healers," Thursday, May 17--NOVA examines the debilitating diseases that feed on poverty and follows various paths to health care in Tanzania, Guatemala, and the United States.

"Black Tide," Thursday, May 24--NOVA documents the Brittany oil spill from the supertanker *Amoco Cadiz*, its effects on the Bretons, and the desperate cleanup attempts.

"The Long Walk of Fred Young," Thursday, May 31--The story of Dr. Frederick Young--a Navajo Indian who, as a child, hunted barefoot and slept under the stars, and today is a nuclear physicist at the Los Alamos Scientific Laboratory in New Mexico.

"A World of Difference: B.F. Skinner and the Good Life," Thursday, June 7--The life and work of B.F. Skinner, the famous and controversial behavioral psychologist and author of *Walden Two*.

"Cashing in on the Ocean," Thursday, June 14--The science, technology, and politics behind the international struggle over the extraction of manganese nodules, rich in copper, nickel and cobalt, from the ocean floor.

"Patterns from the Past," Thursday, June 21--Below the snow-capped peaks of the Peruvian Andes, the isolated Q'eros Indians live a life patterned on that of their ancestors thousands of years ago.

"The Invisible Flame," Thursday, June 28--NOVA examines the potential of hydrogen as a zero-pollution fuel which may replace gasoline in the future.

"The End of the Rainbow," Thursday, July 5--The promise--and problems--of nuclear fusion as a future energy source.

"The Beersheva Experiment," Thursday, July 12--NOVA looks at Israel's Ben-Gurion University Center for Health Sciences, a medical school that is training a new kind of family doctor, physicians who care about the whole person--not just the disease.

"Einstein," Thursday, July 19--A hundred years after Albert Einstein's birth, NOVA presents a film biography that examines Einstein as humanist and philosopher.

"The Keys of Paradise," Thursday, July 26--NOVA studies the amazing properties of the substances known as "endorphins," which are manufactured in the human brain.

(The dates given are those supplied by the WGBH-TV NOVA office in Boston, MA. Individual local stations may reschedule programs.)

P. Publication: Ethical Problems In Engineering

A substantial and useful compendium of materials pertaining to ethical problems in the practice of engineering has been compiled by Robert J. Baum and Albert Flores of Rennselaer Polytechnic Institute. Ethical Problems in Engineering is a rich and varied collection of primary resource documents: articles, commentaries, real and theoretical problem cases, opinions of ethical review boards, and ethical codes of professional engineering societies. Most of the materials are drawn from the newsletters, meeting transcripts, and committee proceedings of various professional groups. Baum and Flores have gathered together a group of informative items from relatively inaccessible sources into a volume appropriate for classroom use.

Contents are divided into four major chapters, each with an author's introduction. Chapter I presents the ethical codes adopted by several of the major engineering societies. In addition, there are analyses of the rationales for such codes, discussions of problems of enforcement, and suggestions for ways of supplementing formal codes. Chapter II offers sets of theoretical problem cases in engineering ethics, each group designed to illustrate a single issue. Cases are then analyzed by several professionals in the context of the codes of their respective organizations. Chapter III provides descriptions, drawn from the published literature, of a number of "actual" problem cases. Differing views of the roles of engineers in society appear in the final section, Chapter IV.

In their preface to the volume, Baum and Flores note the paucity of "secondary materials available at present for inclusion in (the) collection" and express the "hope that the publication of this collection will stimulate engineers, philosophers, and social scientists to begin serious examination of the ethical issues raised in these primary documents."

Ethical Problems in Engineering is available for $7.50 direct from The Center for the Study of the Human Dimensions of Science and Technology. Rensselaer Polytechnic Institute, Troy, NY 12181.

Q. Publication: AAAS Symposium on Research Regulation

A symposium volume based on a day-long session at the 1978 AAAS Annual Meeting, Regulation of Scientific Inquiry: Societal Concerns with Research, has been published by Westview Press as part of the AAAS Selected Symposia Series. Edited by Keith M. Wulff (Concordia College) who, with Rosemary A. Chalk (AAAS) and Hans O. Mauksch (University of Missouri-Columbia), was a co-arranger of the symposium, the volume includes:

Part I. Regulation of Scientific Inquiry--Andre E. Hellegers, "The Ethical Dilemmas of Medical Research"; Barry M. Casper, "Value Conflicts in Restricting Scientific Inquiry"; Hans Jonas, "Freedom of Scientific Inquiry and the Public Interest"; Gerard Piel, "Scientific Research: Determining the Limits"; Robert L. Sinsheimer, "The Presumptions of Science"; and Kurt W. Back, "Secrecy and the Individual in Sociological Research."

Part II. Regulation of Scientific Inquiry in the Context of Recombinant DNA Research--Adlai Stevenson, "Recombinant DNA Legislation"; Philip Handler, "Regulation of Recombinant DNA Research"; and Harold Green, "The Recombinant DNA Controversy: A Model of Public Influence."

Part III. Regulation of Scientific Inquiry and the First Amendment--Thomas I. Emerson, "The Constitution and Regulation of Research"; Harold P. Green, "The Boundaries of Scientific Freedom"; and David J. Newburger, "Effects of Legal Regulation on Scientific Research Using Recombinant DNA Technology."

Part IV. Regulations Protecting Human Subjects--Albert J. Reiss, Jr., "Conditions and Consequences of Consent in Human Subject Research"; Lee N. Robins, "Privacy Regulations and Longitudinal Studies"; Eliot Freidson, "Confidentiality and the Independence of Social Research"; and Hans O. Mauksch, "Regulations of Research as Factors of Accountability and Power."

Part V. Summary and Conclusions--Dael Wolfle, "Classification of Some Problems"; and K.M. Wulff, "Research Regulation, the Public and Professional Organizations."

The symposium was sponsored by the AAAS Committee on Scientific Freedom and Responsibility, AAAS Sections K (Social and Economic Sciences) and T (Information, Computing and Communication) and the American Sociological Association. (221pp.; $17.00 prepaid; order directly from Westview Press, 5500 Central Avenue, Boulder, CO 80301.)

R. NSF Development in Science Education (DISE) Program Seeks Science, Technology, and Society Project Proposals

The National Science Foundation's Development in Science Education (DISE) Program directs its efforts toward increasing the quality and diversity of science education in the United States by funding projects that originate, develop, or experiment with new ideas for improving science education at any level and for any group of people. In particular years, the Program will focus its resources on specific types of activity, populations, or disciplinary areas selected for their national importance or timeliness. Five such areas are being emphasized during the period August 1978 through March 1980:

* Science for the Early Adolescent;
* Improving Access to Careers in Science;
* Science, Technology and Society;
* New Knowledge and New Skills--Education for Productivity; and
* Technology as Applied to Learning.

In focusing on science, technology, and society, the DISE Program is interested in helping to develop and test learning materials and teaching approaches that address two types of problems: 1) that, for the most part, the education of scientists and engineers fails to deal in any depth with the humanistic aspects of their work or to raise the difficult issue of the social responsibilities of science; and 2) that education in the non-scientific professions is equally deficient in its neglect of science, and the general education of most citizens prepares them poorly to deal with contemporary science-related social issues and value problems.

Proposals can address any aspect of the relationship of science, technology and human values--at any educational level. Where appropriate, the collaboration of colleges and pre-collegiate institutions, or of academic and industrial organizations, is encouraged. The following examples may suggest the types of projects which might be supported in this area:

* The science education of persons preparing for careers in the non-science professions, such as law, business, public administration, and teaching;
* Integration of issues of ethics, values, and social responsibility into the professional education of scientists and engineers;
* Development of innovative curricula and materials at precollegiate levels which deal with the social role and consequences of science and technology;
* Encouragement at all educational levels of innovative courses and materials dealing with the interrelationships of science, the arts, and the humanities; and
* Enrichment of the science experience of children and adults through extra-curricular programs, such as science clubs and museum activities, designed to supplement formal science education.

Projects dealing with the physical, biological, or social sciences, engineering, mathematics, technology, or combinations of these disciplines will be entertained. However, the practice aspects of technical, clinical, health, social and business fields are excluded. Assistance will be aimed at developing new methods (having tested utility and reasonable cost) for adapting science education to current circumstances. Where the context permits, DISE projects should produce both a useful new instructional resource and such advances in knowledge of the teaching/learning situation as can be achieved without diffusing the project's principal focus. The activities must show promise of providing new, practical and economical outcomes useful beyond the immediate confines of development activity--i.e., they must not be site-specific. Local implementation or adaptation of already-developed models cannot be funded under this Program. For additional details on restrictions and the types of projects encouraged, request the Development in Science Education Guide for Preparation of Preliminary Proposals (SE 79-50) from DISE, Directorate for Science Education, National Science Foundation, Washington, DC 20550.

S. Announcement: NIE-NSF Program Research on Cognitive Processes and the Structure of Knowledge in Science and Mathematics

The National Institute of Education and the National Science Foundation jointly sponsor a program that supports research on what it means to master a scientific or mathematical topic or skill. Unlike other NIE or NSF programs on immediate classroom application, this program stresses investigations of the structure of important aspects of scientific or mathematical knowledge, and of the cognitive processes involved in learning some scientific or mathematical concept.

Typical programs supported under this program are necessarily interdisciplinary, require expert knowledge of a scientific subject, sophistication in the methods and principles of cognitive psychology, and experience with instruction at the level to be studied, but must deal with the education for, rather than the practice of, a particular field. Studies of cognitive development or general academic skills such as reading are excluded. Sample topics, as given in the program announcement, are:

* Modeling the cognitive representation of some area of scientific or mathematical knowledge;
* Studies investigating the similarities and differences among scientific and mathematical knowledge as formally structured by experts in those fields, cognitive representations of that knowledge in experts and novices, and structures of that knowledge presented in instruction;
* Individual and group differences (including sex differences) in cognitive processes and representations of scientific or mathematical knowledge; and
* Effects of alternate modes of representation--writing, visual and kinesthetic imagery, etc.--upon the learning of scientific concepts.

This grants program was established by interagency agreement and the NIE and NSF contribute equally to program funding. Responsibility for technical oversight is shared; business and managerial responsibility has been assumed by the NSF. To obtain a program announcement, request SE 79-53 from the National Science Foundation, Division of Science Education Development and Research, Washington, DC 20550.

News from the Societies

A. Humanities and Technology

1) The organizers of INTERFACE '79, the Third Annual Humanities and Technology Conference, have issued a call for papers emphasizing the interaction between the humanities and technology; deadline for one-page abstracts is 1 May 1979. The conference, co-sponsored by the English and History Department of Southern Technical Institute and the Humanities and Technology Association, will be held on the Institute campus at Marietta, GA, 25-27 October 1979. For more information (or to submit an abstract), write Drs. Roberta Gates and George Kennedy, Co-Directors, INTERFACE '79, Department of English and History, Southern Technical Institute, Marietta, GA 30060.

2) Humanities Perspectives on Technology, the curriculum newsletter of the Lehigh University HPT Program, recently published a special issue on "Teaching the History of Technology," which included articles and a group of course syllabi and reading lists. The HPT newsletter provides a forum for information exchange in the field of technology studies. Address inquiries to Stephen H. Cutcliffe, Editor, HPT Program, 216 Maginnes Hall #9, Lehigh University, Bethlehem, PA 18015.

B. Environmental History

After a hiatus of several years, the American Society for Environmental History has resumed publication of the Environmental History Newsletter, which features news of the society, and announcements and publications pertinent to environmental studies. For further information, write Keir Sterling, Editor, 54 Livingston Street, Rhinebeck, NY 12572. The newsletter is published by the Department of Social Science, Dyson College of Pace University, Pleasantville, NY 10570.

C. History of Science

1) The Pfizer Award -- This annual prize recognizes "the best published work relating to the history of science in the previous year [1978] written by an American or Canadian author." Nominations for the $1000 cash prize and medal should be submitted, no later than 1 May 1979, to Professor Edith Sylla, The Society for the Humanities, Andrew D. White House, 27 East Avenue, Cornell University, Ithaca, NY 14853.

2) The 1979 Henry Schuman Prize competition for an original essay in the history of science and its cultural influences is open to graduate and undergraduate students in any American or Canadian college, university, or institute of technology. Entries must be received on or before 1 July 1979. For further information, either consult Volume VIII, No. 1 (January 1979) of the History of Science Society Newsletter

(p.5) or contact Professor Mary Jo Nye, Chairwoman, Schuman Prize Committee, Department of the History of Science, University of Oklahoma, Norman, OK 73019.

3) A new bi-annual journal, Trends in History, sponsored by the Institute for Research in History, will publish short essays that will survey recent articles "judged significant to a particular field." The articles will be drawn from approximately 600 international periodicals, on both ancient and modern history of all cultures and on developments in methodology and teaching. For more information, write Patricia Rosof, Trends in History, 55 West 44th Street, New York, NY 10036.

4) Arnold Thackray, new editor of Isis, has asked us to express his interest in receiving scholarly manuscripts that discuss science, technology, and human values in an historical context. Inquiries should be addressed to Professor Thackray, c/o Isis Editorial Office, University of Pennsylvania, 215 South 34th Street, Philadelphia, PA 19104.

5) Book publishers Holt, Rinehart and Winston are sponsoring a paper competition on the history of science education, under the auspices of the National Science Teachers Association. The winner will receive $1000 and travel expenses to the 1980 NSTA convention in Anaheim, CA. Entries must be original scholarly work, approximately 5,000-15,000 words, on some aspect of science education or science teaching in the United States during the past two centuries. Deadline for papers is 1 December 1979. For further information, see NSTA News Bulletin, February 1979; or write to NSTA Headquarters, 1742 Connecticut Avenue, N.W., Washington, DC 20009.

D. Philosophy and Technology

Volume 2 of Research in Philosophy and Technology, edited by Paul T. Durbin (University of Delaware) is now in press and is expected to be available in Summer 1979. This volume will emphasize international scholars and topics in the study of philosophy and technology. Contents will include:

Part I: European Contributions. "Euthyphronics and the Problem of Adapting Technical Progress to Man," Jozef Banka (Katowice, Poland). "Toward an Interdisciplinary and Pragmatic Philosophy of Technology," Hans Lenk and Günter Ropohl (University of Karlsruhe). "Fear and Insight in French Philosophy of Technology," Daniel Cérézuelle (Université de Grenoble).

Part II: Conference Papers, 1976-1977. "Freedom and Determinism in a Technological Setting," Albert Borgmann (University of Montana). "The Normative Side of Technology," Edmund Byrne (Indiana University and Purdue University). "Art in a Technological Society," Phillip Frandozzi (University of Montana). "Marx, Machinery and Alienation," Bernard Gendron (University of Wisconsin-Milwaukee), and Nancy Holmstrom (University of Wisconsin-Madison). "Technological Culture and the End of Philosophy," Michael Zimmerman (Newcomb College, Tulane University), with comment by Robert McGinn (Bell Laboratories).

Part III: Historico-Philosophical Studies. "The Concepts of 'Nature' and 'Technique' According to the Greeks," Wolfgang Schadewaldt (Universitat Tübingen). "On the Nature of Nature," Jacob Klein (St. John's College, Annapolis). "Documentation: Early Analyses of Machines in the French Intellectual Tradition," Alfred Espinas, Jacques Lafitte and Simone Weil. "On the Antagonism Between Philosophy and Technology in Germany and Austria," Werner Koenne (Austrian Elektrizität Wirtschafts-Aktiengesellschaft, Vienna). "Heidegger and Marcuse: Technology as Ideology," Michael Zimmerman (Newcomb College, Tulane University).

Part IV: Reviews and Bibliographies of the work of Hendrik van Riessen, E. Schuurman, and Kenneth Sayre. Also, "Philosophy and Technology and the Verein Deutscher Ingenieure," Alois Hunting (VDI Wülfrath, West Germany). "Philosophy of Technology in France: Overview and Bibliography, 1972-1977," Jean-Claude Béaune (Université de Clermont). "Technology Assessment: A New Type of Science?" Frederick A. Rossini (Georgia Institute of Technology). Also a Supplementary Bibliography compiled by Carl Mitcham and Jim Grote (St. Catherine College).

E. Philosophy of Science

Although feminist thinkers have provided many incisive critiques of the political and social beliefs and practices of patriarchal cultures, less attention has been paid to the underlying theories of knowledge and metaphysics that support those beliefs and practices. Discovering Reality, a symposium volume to be published in D. Reidel's Synthese Library series will specifically address the question of feminist perspectives on epistemology, metaphysics, methodology, and the philosophy of science. The editors of the volume, Sandra Harding and Merrill Provence Hintikka, have issued a call for papers to be included in the book; all papers will be blind reviewed and abstracts and outlines are due 1 August 1979, final papers on 1 November 1979. Suggested topics include: Do feminist social and political theories have consequences for epistemology, metaphysics, methodology, and philosophy of science? Do patriarchal perspectives bias the prevailing theories in these areas? Are the disasters of modern technology symptoms of the misuse of science or of patriarchal biases in prevailing conceptions of nature and of inquiry? For further information, write either: Sandra Harding, Department of Philosophy, University of Delaware, Newark, DE 19711; or Merrill Provence Hintikka, Department of Philosophy, Florida State University, Tallahassee, FL 32306.

F. Social Studies of Science

Volume 4, Number 1 (Winter 1979) of the Newsletter of the Society for the Social Studies of Science contains abstracts of some of the papers presented at the 1978 4S Annual Meeting in Bloomington, IN. The 1979 annual meeting of the society will be held at the L'Enfant Plaza Hotel, Washington, DC, 2-4 November; keynote speaker will be Donald Kennedy, Commissioner of the Food and Drug Administration.

AAAS COMMITTEE ON SCIENTIFIC FREEDOM AND RESPONSIBILITY: 1978 ACTIVITIES

The following highlights of the 1978 activities of the AAAS Committee on Scientific Freedom and Responsibility are excerpted from a condensation of the Committee's 1978 Annual Report, prepared by CSFR Staff Officer Rosemary Chalk.

After two years of activity, the AAAS Committee on Scientific Freedom and Responsibility (CSFR) has identified a range of issues that fall in the areas outlined by its charter. Operating on the thesis that scientists are entitled to certain rights because of the benefits which their profession provides to society, the committee also explicitly views the duality of freedom and responsibility as inseparable--every recognized right of scientific freedom carries an obligation to maintain professional integrity and social responsibility. In 1978, the primary areas of concern for the AAAS Committee on Scientific Freedom and Responsibility were: scientific freedom and human rights, procedures for handling individual complaints submitted by U.S. scientists, scientific responsibility and whistleblowing, ethical principles and practices of scientists and their organizations, revision of the committee charter, and AAAS requests on general ethical issues. Other areas of continuing interest to the committee are scientific freedom and responsibility issues in science education, applicability of constitutional protection for freedom of speech to the right of scientific inquiry, and legal protections for research rights, including the confidentiality of research data.

Scientific Freedom and Human Rights

The major project of the committee is the Clearinghouse on Science and Human Rights. Early in 1978, committee members H. Bentley Glass (chairman), John T. Edsall and Joel Primack wrote to the editor of Chemical and Engineering News in response to an editorial by Sir Andrew Huxley regarding the role of professional scientific societies in the area of human rights concerns. The committee members indicated that political actions violating the human rights of scientists in foreign countries were a matter of deep concern for the professional societies because such restrictions directly interfered with the process of science itself; and they further noted that violations of human rights of scientists in developing countries would lead to an increasing concentration of the world's scientific activity in a handful of developed countries.

The committee also sponsored a symposium, "Human Rights and Scientific Freedom," at the 1978 AAAS Annual Meeting in Washington, D.C., and established liaisons with other groups concerned with scientific freedom and human rights; for example, the Committee on Human Rights of the National Academy of Sciences, and the Committee on the Safeguards for the Pursuit of Science of the International Council of Scientific Unions (ICSU) which held its first meeting in Paris in May 1978.

In other areas of scientific freedom and human rights, the Subcommittee on Infringements of Scientific Freedom in Foreign Countries considered developing an international workshop on human rights in connection with the United Nations Conference on Science, Technology and Development, but came to the conclusion that it lacked the necessary resources to do so. The impact of human rights concerns on scientific cooperation does continue to be a topic of primary concern to the committee, and has also generated discussion in congressional hearings in 1978.

Procedures for Handling Individual Complaints

Since the formation of the committee in 1976, 23 individual complaints by U.S. scientists alleging infringements of scientific freedom or responsibility have been received by AAAS. A subcommittee was established to review these complaints and to determine what role the CSFR should exercise in responding to them.

After several months of informal case reviews, the Subcommittee on Individual Claims drafted working procedures to assist in the review of the complaints. The procedures state that the basic function of the committee in reviewing individual claims will be to "focus the attention of scientific community and the public on issues of scientific freedom and responsibility" rather than to provide a forum for formal adjudication or redress of alleged wrongs.

The subcommittee selected four complaints for further study:

1) A scientist previously employed by a government agency was dismissed on the basis of his refusal to accept a transfer which he believed was a punitive action by his employer. The scientist claims that the transfer was proposed after he had made several allegations about mismanagement and waste of research funds within his division. The scientist further claims that his original allegations were not investigated by his superiors and that following his dismissal, his employers interfered with professional correspondence addressed to his government office.

2) A research scientist working as a principal investigator on a federal grant applied for a renewal of his grant and was denied funding. He claims the denial was based on peer reviews biased by the participation of several individuals whose work would be adversely affected by his initial research results. He further claims that there is no appeal mechanism within the agency for review of the funding panel's decision.

3) A university scientist working as a principal investigator on a multi-year federal contract was informed that his contract was to be terminated and that the research project would be transferred to a government research laboratory. He claims the termination is based on the desire of the agency's management to suppress his research findings which he believes identify public health problems. He also claims that the decision to transfer the project to a government laboratory will create bias in the research work, and may delay attention to the problems he has identified.

4) An engineer in a government agency was demoted for publicly making statements about waste and inefficiency in his agency. He claims the demotion is a violation of his constitutional rights to freedom of

speech, and that the agency sought to make an example of him in order to intimidate other employees.

These claims have been selected for further review because they raise important issues of scientific freedom or responsibility: for example, questions about the rights and obligations of scientists working in government agencies or on government research funds, and questions about the appropriate course of action for scientists concerned about potential hazards to public health or safety, or waste of government funds. The committee staff has collected information from both the claimants and other persons involved in these claims. Subcommittee members are currently drafting opinions on the cases, and in early 1979 the committee will review these opinions in accordance with the new procedures.

Scientific Responsibility and Whistleblowing

At the 1978 AAAS Annual Meeting, the committee sponsored a symposium on "Whistleblowing and Scientific Responsibility: The Management of Technical Dissent." In addition, the Subcommittee on Professional and Social Responsibilities of the Scientist reviewed various procedures, currently required by law or administrative regulations, which represent a model for due process in review of issues of technical dissent raised by scientists. This review has identified "employee protection" sections in various environmental and regulatory laws, including the Federal Water Pollution Control Act Amendments and the Toxic Substances Control Act. The subcommittee is reviewing the implementation of these protections by the Department of Labor, and is also alerting scientists to the existence of these legal protections. Subcommittee Chairman Frank von Hippel and Committee Staff Officer Rosemary Chalk are preparing a major summary of their review of due process protections for technical dissent for publication in 1979.

Committee members also reviewed and commented on a preliminary summary of NRC-proposed regulations for issues of technical dissent. This summary (NUREG 0500) was circulated to many individuals and organizations, and a set of regulations is expected to be published by NRC in 1979. An "employee protection" section was also added to the 1978 authorization legislation for the NRC (P.L. 95-601), and committee members Bentley Glass and Frank von Hippel wrote to Senator Jennings Randolph during Senate consideration of the bill, suggesting additional due process measures to strengthen the protection.

Ethical Principles and Practices of Scientists and Their Organizations

In August 1978 Committee Chairman Bentley Glass wrote to the presidents of AAAS-affiliated societies, as well as to individual scientists who had previously spoken out on issues of scientific freedom or responsibility, and asked them to suggest important topics for the committee's attention. The responses to this request highlight areas of concern about significant ethical principles and practices as identified by scientists themselves. This report suggests the range of divergent attitudes within the scientific community regarding the category of actions commonly referred to as "scientific responsibility," and the committee plans to clarify these actions through further study and discussion.

In early 1979 the committee established a subcommittee to draft a statement of principles of scientific freedom and responsibility to assist the committee in identifying significant areas of ethical concerns. This statement of principles may also eventually guide scientists in their interactions with public policy decisions affecting the impacts and procedures of scientific research.

During 1978 the committee staff officer initiated a preliminary review of the activity of professional societies with respect to ethical principles and practices. In response to a brief survey memorandum, 49 societies affiliated with AAAS indicated that they had "ethics committees," an additional 66 societies indicated that a staff member in their society monitored ethical concerns, and 13 societies responded that they had no staff or committee activity in this area. Plans are being made to expand this review by means of a more detailed survey and workshop discussion.

Revision of the Committee Charter

The initial CSFR charter, drafted in 1976 by the AAAS Committee on Council Affairs, served as a preliminary guide for the committee during its formative years. A revised charter, unanimously approved by the AAAS Council on 7 January 1979, provides a statement of the general purpose of the committee's role as a group authorized to develop ethical principles for AAAS as well as its affiliated societies. The new charter explicitly recognizes the dual aspects of scientific responsibility, commonly referred to as "professional" and "social" responsibility: a concern for the integrity of science _and_ the application of science in the promotion of human welfare. The charter also provides for the maintenance of existing clearinghouse projects of the committee.

The AAAS Board of Directors has appointed John T. Edsall (Harvard University) as Committee Chairman to succeed Bentley Glass (State University of New York at Stony Brook). Dr. Glass will continue to serve as a member of the committee. Other members are: Robert Baum (Rensselaer Polytechnic Institute), William Bevan (Duke University), Thomas J. Cleaver (University of Texas, San Antonio), Harold P. Green (George Washington University), Charles A. Mosher, Peter Petkas (Office of Management and Budget), Joel Primack (University of California, Santa Cruz), Jeremy J. Stone (Federation of American Scientists), Jessica Tuchman Matthews (National Security Council), Frank von Hippel (Princeton University), Dael Wolfle (University of Washington, Seattle).

The full 48-page Annual Report of the Committee on Scientific Freedom and Responsibility is available for $2.00 (prepaid) from the AAAS, 1515 Massachusetts Avenue, N.W., Washington, DC 20005 (Order No. SFR-9).

REVELATION AND HERESY IN SOCIOBIOLOGY: A REVIEW ESSAY*

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Wilson, Edward O. Sociobiology: The New Synthesis. Cambridge, MA: Harvard University Press, 1975.

Wilson, Edward O. On Human Nature. Cambridge, MA: Harvard University Press, 1978.

Gregory, Michael S., Anita Silvers, and Diane Sutch, eds. Sociobiology and Human Nature. San Francisco, CA: Jossey-Bass Publishers, 1978.

Caplan, Arthur L., ed. The Sociobiology Debate: Readings on Ethical and Scientific Issues. New York: Harper and Row, Publishers, 1978.

Introduction

Sociobiology, like all other scientific lines of inquiry, will ultimately be tested by its results. If it provides a useful framework for asking and answering questions that are important to scientific investigators, it will be incorporated into the body of scientific knowledge and become part of our understanding of ourselves and our habitat. Whether sociobiology really provides such a framework will not be discussed here, though I will say at once that I have come to the conclusion that it does. What is more interesting for our present purposes is to inquire what there is about the questions it purports to ask and answer, and the way in which it proposes to ask and answer them, that has occasioned the controversy of the past several years.

I have been referring to sociobiology as "it," implying some sort of distinct entity. The comparative and evolutionary study of social behavior has a considerable history and many investigators have contributed to it. However, the content and methods of the field are currently defined in both substantive and symbolic terms by a single book: E.O. Wilson's Sociobiology: The New Synthesis. This remarkable work has sold more than 45,000 copies since its publication in 1975--an astonishing total for a lengthy and expensive book of theory and data that is addressed primarily to a scientific audience. The first reviews, written by biologists and appearing in scientific journals, were almost entirely laudatory. But the book soon came to the attention of a much larger audience, initially as a result of a severe attack launched against its ideas and its author by the Boston-Cambridge Science for the People group. The debate has since engaged a very wide range of intellectuals, including (in addition to biologists) social scientists, historians and philosophers of science, and political essayists, and has received attention in the popular press as well.

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All of the elements in this debate are exhibited in the volumes edited by Caplan and by Gregory, Silvers, and Sutch. Caplan's book of readings reproduces significant essays and excerpts that deal with some of the historical forerunners of sociobiology, some examples of sociobiological work, and most of the main lines of criticism that have been advanced. The symposium volume edited by Gregory et al. contains essays by a wide range of specialists; they are inevitably uneven in quality, but cumulatively throw some light on most of the important issues. Unfortunately, there does not emerge from either book anything approaching an adequate picture of the principles, methods and data on which Wilson's synthesis is based; for this, and to avoid the kind of controversy that feeds only on itself, one must go back to the source. But if you have already read Sociobiology, and if you are prepared to put up with a considerable amount of repetition and obfuscation, you can get from these two collections a fair picture of the quality and quantity of the arguments that have been advanced.

Sociobiology is a scientific treatise, and its author is more explicit than most in trying systematically to lay out his basic assumptions, to clarify his principles of analysis, to specify the limitations of his data, and to present his conclusions cautiously and conditionally. But Sociobiology is also a manifesto, informed by Wilson's orderly vision of nature and designed to persuade us of its truth, its beauty, and its importance in guiding us to right action. It is the latter aspect of the book that has caused most of the trouble, partly because the reader cannot help responding (if only unconsciously) to the passion that infuses the enterprise as well as to its manifest content. But it is also the case that Wilson, in ardent pursuit of his vision, apparently unaware of his biases, and perhaps seduced by his own artful rhetoric, becomes incautious in his use of evidence and in the claims he makes for his subject and its scientific and social implications.

These difficulties are most apparent in the last chapter of Sociobiology, in which the author attempts to extend the general argument of the entire work (otherwise concerned only with non-human behavior) to Homo sapiens, and in Wilson's most recent book, On Human Nature, which is devoted entirely to this subject. There has been very little criticism of Wilson's vast array of analyses of the social behavior of slime molds, bumblebees, jays, and baboons. Only when Wilson gets to humans does the tempest roar, and it is precisely here that he is most vulnerable. This should not be surprising; there has been a good deal of sociobiological research on other forms of life but very little on humans, and Wilson's specialty is insects, not men and women. Unfortunately, the logic of his argument and his zeal to extend it to all possible domains leads him here to commit the sins for which he criticizes others: ad hoc terminology, the fallacies of affirming the consequent and simplifying the cause, and the advocacy method of developing science.*

Some criticisms of sociobiology, therefore, are more concerned with Wilson's particular formulation of the subject than with the fundamentals of the subject itself. I suspect that someone with access to a wider range of data about human behavior, or someone with more caution and less of a mission, might have been able to advance the same line of argument without creating so much fuss. I do not mean to reduce the entire controversy to a trivial debate about the idiosyncrasies of E.O. Wilson; the sociobiological view of the world and of humanity would raise important issues no matter who advanced it. But it is Wilson's special vision and his remarkable expository skills that have made these issues matters of consequence at the present time.

Scientific Materialism and the Evolutionary Epic

Sociobiology is based on the tenets of scientific materialism. These tenets are taken largely for granted in *Sociobiology* and made explicit in *On Human Nature*. They consist essentially of a belief in the existence of an objective reality, in which all events are determined by consistent forces that are themselves part of the reality and that are (at least in theory) capable of description by the application of the methods of scientific inquiry. The world view that results from this belief system has no room in it for the immaterial, for ultimate purpose, or for any class of events that is exempt from its universality.

There is little comfort for humanity in this doctrine. It lumps us in with the rest of the clay around us as the accidental product of forces not under our (or anyone else's) control; it leaves us without souls and without purpose; it reduces the achievements on which we most pride ourselves to epiphenomena, interesting perhaps but not germane to our long-run survival. And although science lives on the power of revelation that its practitioners experience in their work, scientific materialism has denied our older revealed faiths without advancing any claim to a new one.

But now listen to Wilson; it is worth quoting him (from the closing pages of *On Human Nature*) at some length:

> In the absence of ordinary sensory information from the outside, the cortex responds by calling up images from the memory banks and fabricating plausible stories. In an analogous manner the mind will always create morality, religion, and mythology and empower them with emotional force. When blind ideologies and religious beliefs are stripped away, others are quickly manufactured as replacements. . . .This mythopoeic drive can be harnessed to learning and the rational search for

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* For evidence see Caplan and Gregory *et al.*, *passim*. See also the critique by Lewontin,[1] which, unfortunately, is not reproduced in the Caplan volume.

> human progress if we finally concede that scientific materialism is itself a mythology defined in the noble sense. . . .
>
> The core of scientific materialism is the evolutionary epic. Let me repeat its minimum claims: That the laws of the physical sciences are consistent with those of the biological and social sciences and can be linked in chains of causal explanation; that life and mind have a physical basis; that the world as we know it has evolved from earlier worlds obedient to the same laws; and that the visible universe today is everywhere subject to these materialist explanations. The epic can be indefinitely strengthened up and down the line, but its most sweeping assertions cannot be proved with finality.
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> What I am suggesting, in the end, is that the evolutionary epic is probably the best myth we will ever have. It can be adjusted until it comes as close to truth as the human mind is constructed to judge the truth. And if that is the case, the mythopoeic requirements of the mind must somehow be met by scientific materialism so as to reinvest our superb energies.[2] . . . .
>
> The true Promethean spirit of science means to liberate man by giving him knowledge and some measure of dominion over the physical environment. But at another level, and in a new age, it also constructs the mythology of scientific materialism, guided by the corrective devices of the scientific method, addressed with precise and deliberately affective appeal to the deepest needs of human nature, and kept strong by the blind hopes that the journey on which we are now embarked will be farther and better than the one just completed.[3]

Here we see the vision that moves Wilson and informs his work. Those of us who have abandoned the old faiths are offered a new one appropriate to our needs and times, majestic in its sweep, consistent with our belief in scientific rationality, and restoring a sense of purpose to our activities. Other such statements have left us on the outside looking at the icy distances among the stars and the fetid struggles of organisms for survival; this one puts us again at the center of our world, creating our own myth and capable of using our growing understanding to determine our own destiny.

This aspect of Wilson's work has been very little discussed, but I believe it helps to explain the intensity of the response--both favorable and critical--that it has evoked. Part of the problem lies in the discomfort of the scientific community when faced with any statement of faith, even one that purports to be based on scientific principles. (The discomfort grows when, as in this case, there seems to be an effort by a member of the community to proselytize the laity, and grows further when the effort appears to be successful.) Modern scientists are trained as bricklayers, not as architects; they build their structures stone by stone, seeking the design that is inherent in them rather than conforming to the requirements of a master plan. Their belief is in attitudes of mind and methods of analysis that are hostile to propositions that are unprovable and unfalsifiable, including all forms of mythologies, superstitions, and revelations old and new. It is therefore not surprising that in spite of the power and appeal of the evolutionary epic as a basis of faith in the scientific enterprise, some members of the scientific community should regard it with suspicion and derogation.

But there is a good deal more to the response to sociobiology than a generalized mistrust of Wilson's vision of its significance, and also more than a simple effort to identify its weaknesses by applying the conventional tools of critical analysis. At the deepest level, the argument transcends the specifics of sociobiology and has to do with the fundamental doctrines of scientific materialism and their acceptability as the basis of human understanding and conduct. It appears to me that most of the criticisms are addressed to three major issues of this kind, in which ideological commitments play a larger part than questions of the appropriate use of evidence or the acceptable limits of generalization. These issues overlap and reinforce each other in various ways in the critical literature, but for analytical purposes I will treat them as independent in the discussion that follows.

The Nature of Human Nature

Sociobiological theory asserts without compromise or equivocation that human beings are part of the same reality and subject to the same evolutionary forces as all other forms of life. Most of its critics are concerned in one way or another to deny, refute, or demonstrate the emptiness of this assertion.

One group of critics, including mainly philosophers and other humanists and also some anthropologists, simply opposes one assertion with another. They find a variety of reasons for affirming the uniqueness of the human species: speech, language, and more generally, the use of symbols; noncorporeal conceptions of mind, consciousness, and purpose; and the notion of culture (of which more will be said below). Their reasoning is based primarily on intuition; at best it grows out of the long tradition of philosophical discussion of human nature, but does not attempt to deal seriously with the biological evidence on the subject.

A second group of critics, mainly anthropologists, is willing to accept the notion that at some level we are the products of our evolutionary history. They argue, however, that with the development of human culture, the effect of our genes on our social behavior has become insignificant. Unlike other animals, they say, the basic patterns of human behavior result from social rather than biological inheritance. The evidence they bring forward is primarily the enormous variability of human culture, in which exceptions can be found for every generalization, and the rate of cultural change, which far exceeds the pace of genetic evolution.

One of the questions at issue here has to do with levels of analysis of behavior. To quote Wilson again:

> There are social traits occurring through all cultures which upon close examination are as diagnostic of mankind as are distinguishing characteristics of other animal species--as true to the human type, say, as wing tesselation is to a fritillary butterfly or a complicated spring melody to a wood thrush. In 1945 the American anthropologist George P. Murdock listed the following characteristics that have been recorded in every culture known to history and ethnography: Age-grading, athletic sports, bodily adornment, . . .visiting, weaving, and weather control.[4]

The principal focus of sociobiological analysis is thus on the identification and explanation of invariant characteristics within and among species. The main concern of cultural and social anthropologists, on the other hand, is to describe and account for the intra-specific variation of our own species. The sociobiologists are interested in the ultimate limits that were set for the human phenotype by the events of our genetic history, and argue that human culture in all its varied forms can be fully and properly understood only against this background. The anthropologists are more interested in proximate than ultimate causes of behavior, and argue that they can be found in cultural rather than genetic influences on the phenotype.

It is understandable that critics of this general persuasion should say that they find sociobiological analysis uninteresting or useless when it is applied to their problems. It is also understandable that they should question whether the items on Murdock's long list are appropriate as diagnostic traits for Homo sapiens, and the way and the extent to which such traits can be shown to express genetic forces. Criticism of this kind does not invalidate sociobiology as such or deny the possibility of its further refinement as a scientific discipline that is useful for its own purposes. But many of the critics who advance these arguments are not content with such limited conclusions. Their purpose in raising them is to demonstrate that the development of culture has freed human beings from all the rules that govern the behavior of other animals and therefore that sociobiology is not merely useless in result but wrong in principle.

A third group of critics, mainly biologists, speaks directly to the adequacy of sociobiological theory and methods. The most cogent critique of this kind comes from Lewontin, whose own work might lead us to expect from him greater sympathy for materialist and evolutionary reasoning. His essay (see Note 1) deserves careful reading, and I will not try to summarize it here. It is addressed not at all to sociobiology applied to other forms of life, and is intended only to show "why it cannot offer a real understanding of the genesis and meaning of human social organization."

As I have already suggested, it is with respect to human behavior that the present state of sociobiology and Wilson's particular expression of it are least adequate, and the further development of the field in this direction will depend on its ability to deal with criticism of the kind advanced by Lewontin and others. In this case, as in the others we have examined, the failure of the critics even to address--let alone to invalidate--the application of sociobiological analysis to non-human forms of life leaves their arguments logically defective. The sociobiological ark is designed in theory to have room in it for every kind of animal, including Noah and his family. Its accommodations may have to be improved in many ways if it is to carry human beings safely and comfortably, but it does not follow from this observation that human beings need an altogether different kind of vessel to get them to dry ground.

The common thread that I find in these several lines of criticism is by now apparent. In the end, they all come down to an assertion not only that Homo sapiens is unique (which is true by definition for all species) but that we are uniquely exempt from the application of laws that appear to govern the behavior of all other forms of life. It is on this issue that the resistance to sociobiology centers, even among scientists who unhesitatingly accept the premises of scientific materialism and evolutionary theory in all other respects. How are we to account for the peculiar nature and intensity of their resistance?

I suggest that we are witnessing a response to heresy. Sociobiology provides a doctrine that is fundamentally at variance with the notion of the special creation of man, which has been embedded in Western belief systems from their beginnings. The persuasiveness of this notion comes from our intuitive perception of ourselves and is reinforced by the enormous power of the truths revealed to our fathers and established in our society. Scientists have no more difficulty in maintaining simultaneous adherence to contradictory beliefs than anyone else, and, often unwittingly, they carry around on their backs (as Marx said of Hegel) "the eggshells of discarded philosophies." The attack on sociobiology is in this respect only a continuation of the battle that began in 1859; the debate with Bishop Wilberforce has not yet ended.

"Reductionism" and Territorial Defense

The possible implications of sociobiology would be cause for concern among social scientists in any event, but Wilson states them in a way that is especially threatening:

> Let us now consider men in the free spirit of natural history, as though we were zoologists from another planet completing a catalog of social species on Earth. In this macroscopic view, the humanities and social sciences shrink to specialized branches of biology; history, biography, and fiction are the research protocols of human ethology; and anthropology and sociology together constitute the sociobiology of a single primate species.[5]
>
> It may not be too much to say that sociology and the other social sciences, as well as the humanities, are the last branches of biology waiting to be included in the [Neo-Darwinian] Modern Synthesis. One of the functions of sociobiology, then is to reformulate the foundations of the social sciences in a way that draws these

> subjects into the Modern Synthesis. Whether the social sciences can be truly biologicized in this fashion remains to be seen.[6]

These statements, and Wilson's comments elsewhere on the present weakness of social scientific thought,[7] are ample cause for the protests that have been raised in many university departments of sociology and anthropology. The apparent strength and security of these departments is more the result of social and economic forces than of their scientific achievements, and their members are not yet fully accepted as legitimate by the scientific community. The most vehement defense of status always comes from those who are least secure, and it is not at all surprising that the sociobiological program, especially when it is stated with Wilson's ingenuous blend of arrogance and condescension, should arouse vigorous opposition.

But on what grounds can the opposition properly be stated? As we have seen, it relies in part on an assertion of the unique exemption of the human species from biological forces; it also relies on certain political observations and attributions, which are discussed below. A third major line of opposition, to be considered here, consists of an effort to dismiss sociobiological thought because it is said to be "reductionist" in nature and therefore unacceptable as a mode of analysis.

Webster's New World Dictionary defines reductionism as "any method or theory of reducing data, processes or statements to seeming equivalents that are less complex or developed," and adds that it is "usually a disparaging term." Nonetheless, among natural scientists reduction is a comfortably familiar procedure on which much of the structure of scientific theory is based. Many of the most important advances in scientific thought result from the conceptual simplification of complex phenomena in order to test the significance of their fundamental elements. Everywhere in physics, chemistry, and biology, we see the fruitful interplay of explanations of events occurring at different levels of organization of matter. Why then should reductionism have become a dirty word among social scientists?

For the answer, I think we must look to the history of ideas in these fields and the efforts of their practitioners to establish and maintain the autonomy of their disciplines. The founders of modern sociology and anthropology--notably Durkheim and Boas--attempted to define the scope and nature of their fields in a way that would give them distinctive content, internal consistency, and some degree of protection against the competing claims of others to the same territory. In the intellectual climate of the late 19th and early 20th centuries, these claims came from a variety of sources, including geographers, psychologists, biologists, and economists, all of whom were prepared to explain the origin and nature of social behavior and institutions in their own terms. Most of these explanations, and especially those of the social evolutionists and the Marxists, expressed a simple determinism that was questionable on scientific grounds and unacceptable on ideological grounds. The solution of the Founding Fathers was to exclude from consideration the possible influence of all independent variables exogenous to social systems, as summarized in Durkheim's famous dictum that social facts must be explained by social facts.[8]

This dictum has turned out to be more than a useful weapon against territorial aggression. It has become an unquestionable article of faith among social scientists, part of the catechism taught to every student of sociology and anthropology, and carries with it all the authority of revealed truth and social consensus. The "reductionism" of sociobiology in this context is simply another name for a familiar sin: once again, we hear the voice of heresy. The attempt to "biologicize" the social sciences is resisted with the same ferocity that the Roman Church brought to bear on the Albigensians, and for the same reasons.

Science as Politics

As soon as the sociobiologists began to talk about human beings, they entered the arena of combat in which political critics and commentators conduct their affairs. The rules of this arena prohibit neutrality; all participants must be identified in terms of the extent to which their actions can be used to reinforce or to change the established order. This identification is generally based as much on an examination of a writer's background and associates as on the content of his work and his own expressions of purpose.

Criticism in this vein has come from several sources, notably the Sociobiology Study Group of Science for the People.[9] Their attack is centered essentially on two themes: First, the sociobiological model is said to rest on a set of assumptions that do not derive from the data of human behavior, but instead reflect the social arrangements and ideology of the capitalist system. Second, these assumptions, and the analytical methods associated with them, are said to result in conclusions--for example, with respect to genetic variation between the sexes and among "racial" groups--that reinforce the most exploitative aspects of that system. It follows that sociobiology is invalid in both content and purpose and should be denied scientific and social legitimacy.

The inaccuracy and vindictiveness of the polemics of Science for the People should not blind us to the significance of these charges. Their critique reflects a recognition of the extent to which the scientific enterprise as a whole has become identified with the purposes of the state. Robert Morison has aptly commented on the reversal in our time of the historic roles of religion and science, one as the main ideological buttress of the ruling class and the other as an instrument of subversion.[10] Much of the hostility exhibited by the contemporary left toward science and technology is ultimately directed at those who have the power to buy the loyalty of scientists and use their work for what are regarded as anti-social purposes. Wilson is an eminent professor whose research has been largely funded by the Federal Government and who works at an institution that takes pride in its intimacy with wealth and power; he is obviously fair game for this kind of hunt.

Sociobiology postulates a relationship of individuals to their environment and to each other that closely parallels the constructs of neoclassical economics, and this similarity raises further questions. Both "the selfish gene" (to use Richard Dawkins' term[11]) and "economic man" are conceived as entities that serve only their own needs; thus what we observe as social behavior (including such phenomena as reciprocal altruism and cooperation, or the level of wages and prices) is said to be an aggregate of individual decisions in which each entity is trying to maximize its own chances of success. The competition of individual entities for resources generates a tendency toward an equilibrium solution for the aggregate, in which no change in behavior can improve the outcome for any of its elements. The economists have developed powerful and sophisticated techniques for the analysis of processes of this kind, and the sociobiologists have been glad to share this ready-made set of tools as well as the observations and theorems to which it can be applied.

The work of the classical economists can be regarded as an effort of generalization based largely on the economic institutions and processes of English and European society in the 18th and 19th centuries. The development of neo-classical economics reflects a continuous effort to construct a still more general body of theory that can be applied everywhere and to all kinds of individual and social behavior. In the hands of its modern practitioners, its conclusions are said to be positive rather than normative--to describe what is rather than what ought to be. But the content of this intellectual tradition remains profoundly conservative in implication, both in the literal sense that it emphasizes constraints and stability rather than possibilities for radical change, and in the political sense that it is easily converted into a defense of laisser-faire capitalism. To the extent that sociobiology starts from the same premises and arrives at the same kind of conclusions, it can be tarred with the same brush.

The trouble with this line of reasoning is that it is impossible to invalidate scientific (or any other) conclusions exclusively on the grounds that they are based on false premises or that they are used for improper purposes. Pierre van den Berghe observes that "The few, limited bodies of proto-theory that 'work' in social science (by the usual scientific canons of parsimony, predictiveness, reproducibility, and so on) are those that are predicated on the selfish pursuit of self-interest: classical economics, behaviorism, Marxist class theory, exchange theory, and game theory"--and now sociobiology.[12] Whether or not one agrees with this assessment, it is by standards of this kind that the results of economic and sociobiological analysis will finally be judged. Either these analyses will contribute to our ability to understand and exert some control over the forces that affect our welfare or they will ultimately be rejected, regardless of their acceptability to one or another group of partisans.

A further aspect of the political critique that deserves our attention is the issue of "determinism." The Science for the People group ends its onslaught on sociobiology in the following words:

> Finally, determinists assert that the possibility of change in social institutions is limited by the biological constraints on individuals. But we know of no relevant constraints placed on social processes by human biology. There is no evidence from ethnography, archaeology, or history that would enable us to circumscribe the limits of possible human social organizations. What history and ethnography do provide us with are the materials for building a theory that will itself be an instrument of social change.[13]

Once again, our interest here is not in the argument about the extent to which social behavior is constrained by biology but in the forces that appear to generate the argument itself. What emerges from the quoted passage and similar criticisms of sociobiological determinism is not only a denial of gene power but also an affirmation of people power and an assertion that the two are incompatible. Wilson has gone to great lengths in *On Human Nature* to dispute this assertion, and to establish his credentials as a political liberal by arguing that a better understanding of biological constraints leads to more rather than less freedom for constructive social action. However, the weight of this argument may not count for much against the heavy commitment of contemporary liberals to a belief in human perfectibility.

This doctrine has a long history, from Plato to Thomas More to Herbert Spencer to the latter-day offspring of Rousseau and Karl Marx. Spencer and Marx shared in the 19th-century notion of Progress as the inevitable outcome of natural forces. In the 20th century, this kind of determinism has been largely rejected and the achievement of a perfect society is regarded as contingent upon human action. It is an essential tenet of modern liberal and socialist ideology that the behavior of human beings is conditioned only by institutions and processes that they can manipulate freely to achieve their consensual goals. By suggesting limits to this freedom, however remote and tenuous they may be, the sociobiologists are in effect denying the possibility of a perfect humanity. In doing so, they are once again controverting a fundamental article of faith and have made themselves subject to the penalties appropriate to heresy.

Conclusion

From a narrow scientific point of view, what is important about the new discipline of sociobiology is the possibility it offers for the development of a wide range of original and testable hypotheses about social behavior. The evidence presented in Wilson's major work of synthesis suggests that this possibility has already been realized to a considerable extent for many non-human forms of life, to a lesser degree for cross-specific generalizations, and least of all for *Homo sapiens*. The evidence also suggests, however, that there is every reason to assume that this species has been subject to the same evolutionary forces as all others, and no reason to assume *a priori* that the way and the extent to which its behavior has been affected by these forces cannot be determined. The proof of this pudding will be in the eating, and we will never know what nourishment we might get from it if we shoot the cook when he has just entered the kitchen.

The purpose of Wilson's recent book, *On Human Nature*, is to defend and amplify his argument about how sociobiological analysis can be extended to human behavior and what might be the implications of such an extension, for the study of human beings and for humanity itself. I believe it is primarily these implications, rather than the substance of the argument, that have caused most of the controversy that has emerged, and I have tried to suggest why this should be so. I can think of few episodes in the history of science where the way in which scientific thought is conditioned by faith and dogma is more dramatically evident. For this demonstration alone, we might be grateful to Professor Wilson and his critics. But their controversy has also served to focus our attention once again on the fundamental issues proper to the study of human beings, and for this, too, we are much in their debt.

NOTES

1. Richard C. Lewontin, "Sociobiology--A Caricature of Darwinism." in PSA 1976, Volume 2 (East Lansing, MI: Philosophy of Science Association, 1977), pp. 21-31.

2. Edward O. Wilson, On Human Nature (Cambridge, MA: Harvard University Press, 1978), pp. 200-201.

3. Ibid., p. 209.

4. Ibid., pp. 21-22.

5. Edward O. Wilson, Sociobiology: The New Synthesis (Cambridge, MA: Harvard University Press, 1975), p. 547.

6. Ibid., p. 4.

7. See, for example, Edward O. Wilson, "Biology and the Social Sciences," Daedalus (Fall 1977), pp. 127-140.

8. Émile Durkheim, The Rules of Sociological Method (1925).

9. Sociobiology Study Group of Science for the People, "Sociobiology--Another Biological Determinism," 26 BioScience 3 (March 1976); also in Arthur Caplan, ed., The Sociobiology Debate (New York: Harper and Row, Publishers, 1978), pp. 280-290. For responses, see Edward O. Wilson, "Academic Vigilantism and the Political Significance of Sociobiology," and Nicholas Wade, "Sociobiology: Troubled Birth for New Discipline," also in Caplan, op. cit., pp. 291-303 and 325-332.

10. Robert S. Morison, "Introduction" to "Limits of Scientific Inquiry," Daedalus (Spring 1978), p. vii.

11. Richard Dawkins, The Selfish Gene. (New York: Oxford University Press, 1976).

12. Pierre L. van den Berghe, "Bridging the Paradigms: Biology and the Social Sciences," in Michael S. Gregory et al., eds., Sociobiology and Human Nature (San Francisco, CA: Jossey-Bass, 1978), p. 40.

13. Sociobiology Study Group, in Caplan, op. cit. (Note 9), p. 290.

PUBLIC INVOLVEMENT IN THE DNA CONTROVERSY: THE CASE OF CAMBRIDGE, MASSACHUSETTS[1]

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When a handful of molecular biologists gathered in 1973 and 1974 to consider the implications of a striking new technology called recombinant DNA, they quite naturally envisioned a fairly routine internal discussion, part of an ongoing series on the safety of laboratory procedures. In the case of recombinant DNA, their concern was that hybrid DNA molecules, produced by splicing together the DNA of different species, would yield new, unpredictable, and perhaps dangerous, forms of microorganisms.

Just as unpredictable, however, were the political forces that coalesced around the DNA issue.[2] To the consternation of the scientists and the confusion of policy-makers, recombinant DNA became a testing ground for emerging national concepts in public participation. In the early stages of the DNA debate (1973-1975), policy-making was largely initiated and controlled by scientists and administrators involved in biological research, that is, by researchers with little experience or expertise in public participation. Their role was a reactive one, a succession of stopgaps, and finally a painful accommodation to increasingly "foreign" pieces of politics inserted in their normally private decision-making machinery. The first lay group on the scene was the press, whose interest and coverage alerted the scientists and politicians to potential public interest in the debate. Second to be involved were the professional associates of science--lawyers, ethicists, political scientists--invited to scientific gatherings in token numbers as a reasonably comfortable way to provide for the "lay" point of view. Third was the familiar Congressional scrutiny, here represented by Senator Edward Kennedy. He called hearings of the Senate Subcommittee on Health and Scientific Research in 1975, in which he stressed the need for greater public involvement; but Kennedy's Congressional colleagues took little interest until the issue later escalated. In the meantime, increasing numbers of academics became involved as campus-wide discussions proliferated at universities such as Michigan and Harvard, where laboratories were being prepared for higher-containment recombinant DNA experiments.

The forms of lay participation in the DNA debate were, until 1976, not unfamiliar or unusual: press, professional associates, Congress, academic colleagues. Then, in Spring 1976, a remarkable change occurred: the city government of Cambridge, Massachusetts tackled the issue, and a group of local citizens began to involve themselves in the DNA regulatory process.

The Cambridge experience was largely regarded as not only unprecedented but successful.[3] The process was considered democratic and the outcome reasonable, a victory for public participation in science policy decisions. Curiously, combatants on all sides seemed relieved and pleased. Scientists and politicians began to point to Cambridge as a model for citizen participation in scientific decision-making. Later, as the Cambridge legend grew, it took on mythical, and even contradictory dimensions: Cambridge pointed up the potential for effective public participation in science or Cambridge pointed up the potential for dangerous public meddling in science; Cambridge had taken the DNA issue to the "man-in-the-street" or Cambridge had fallen victim to the agitation of a few scientist-critics; Cambridge had "exonerated" the policies of the DNA scientists or Cambridge had revealed the depth of lay anti-science sentiments. If Cambridge is to assume proper perspective in the analysis of lay participation, we must first separate myth from reality, and take a closer look at the limitations as well as the strengths of the process that took place. Reviewing the historical records,[4] one finds a story of failures as well as successes, with lasting and generalizable lessons for the future of public involvement in science.

What happened, briefly, is that in Spring 1976 the Cambridge city government became involved in a lively and bitter dispute taking place at Harvard University over the safety of a proposed new laboratory on campus that would house some types of recombinant DNA experiments. While a few members of the administrative branch of the city government were trying to decide how to handle the situation, the city's colorful mayor, Alfred Vellucci, heard of the issue. A veteran of the kind of politics that pits town against gown, Vellucci took the debate to the City Council and called for public hearings. At the hearings, the response of the universities, scientists, and press was so strong, sensitized as they were by the ongoing national debate, that the City Council called a temporary moratorium on higher containment DNA research (recognizing that this would cause almost no inconvenience to the universities) and created a Cambridge Laboratory Experimentation Review Board to study the matter. The Board, consisting of nine local citizens, heard testimony from scientists, then recommended that the city draft an ordinance, based on the new voluntary federal guidelines, with slightly stricter containment levels and laboratory procedures and with provisions for a city biohazards committee to monitor local laboratories. After more hearings, the City Council passed an ordinance in February 1977, about eight months after the city conflict began.

In some ways, however, the city's role was not as influential as it seemed. The City Council hearings were a response to the controversy that had been brewing on the Harvard campus for four months, and the Harvard debate was simply transplanted to the City Council chambers, with the same parameters, arguments, and participants. Scientists continued to control the scope of the debate, the underlying assumptions, and the composition of the opposing sides.[5] Barbara Culliton of *Science* magazine later described the process as an "interesting phenomenon of a 'public' debate on recombinant DNA that really amount[ed] to a debate between two scientific camps slugging it out in public."[6]

At first it appeared that the DNA proponents, who had kept the upper hand in the academic area, would lose their influence in the city arena. By the time city hearings were called, the university was in the final stages of approving the new laboratory, after a somewhat pro forma hearing of critics' views. In the public arena, however, proponents and opponents were more evenly matched, since by lay standards their credentials were comparable. Mayor Vellucci, a canny politician, pressed the critics' advantage by emphasizing the non-academic nature of the City Council proceedings (opening the first hearing with a high school chorus rendition of "This Land Is Your Land," for example) and by badgering Harvard administrators and proponents about their elitism.

The proponents found ways, however, to compensate for the increased credibility that the lay setting gave the critics.[7] For example, Harvard lost no time in using its public relations machinery to provide backing for the proponents. Strategy sessions were organized to coordinate the efforts of Harvard and MIT administrators, scientists, and public relations specialists, with consultations from lawyers and the two presidents. It was decided in these sessions to invite national figures to the hearings to impress the city audience on behalf of Harvard--"to sandbag them with more heavyweights," as one proponent later bluntly put it.[8] Harvard's Assistant Vice President for Community Affairs and MIT's Special Assistant to the President for Urban Relations also orchestrated standard lobbying efforts. It was "almost aggravating," one City Councillor said, the number of times the universities called him--as often as five or six times a day. Arrangements were also made for the Councillors to visit Harvard and MIT labs, and for Nobel Prize-winners nationwide to write Vellucci supporting the research. The extent of the universities' public relations efforts prompted one Harvard biologist to reflect later, "I remember being quite surprised at the vast resources they had to influence the community, and they all seemed to get dragged in on this. And I all of a sudden became aware of this whole organization that worked behind the scenes to influence the public."[9]

On the other side, the involvement of DNA critics, although far greater than in previous national hearings, was less effective than it might have been. First, the critics were, partly as a matter of principle, less organized, and were careful to preserve individual autonomy. Some belonged to Science for the People and met informally to divide up responsibilities; but others, including Ruth Hubbard and George Wald, worked independently, and communication was spotty. The scientist-critics were also not in close touch with the politician-critics, like Vellucci. In short, the critics had no institutional base to provide support and no matrix for organization. Second, some of the scientist-critics felt ambivalent about taking part in the debate, as they later indicated in interviews; they were reluctant to testify in opposition to colleagues, friends, and superiors, and fearful of social and professional alienation.[10] Third, the critics, in spite of Vellucci's apparent favoritism, were scheduled to appear after Harvard's presentations; as a result, they ended up speaking at the late, hot, tired end of the evening and for only about one-third of the total hearing time. Fourth, although the critics tended to be more comfortable than their proponent counterparts with the political atmosphere of the proceedings, their political experience brought with it a reputation for being leftists or "kooks", in contrast to the proponents' image of prestige and respectability. In fact, at least one conservative Councillor made up his mind on the DNA issue during the first hearing, on the basis of the status of the proponents and his distaste for "all those radical groups."

According to subsequent interviews, the Cambridge City Councillors quickly gave up trying to understand the technical issues. Instead, they focused on one basic decision: was the DNA issue important enough to warrant city action? They decided it was, mainly on three essentially non-technical grounds: (1) the size of the response from Harvard and MIT, the press, and the scientists; (2) the size of the rift between proponents and opponents, with impressive credentials and heavy emotion on both sides; and (3) their view that the scientists at Asilomar, NIH, and Harvard had been delinquent in their provisions for public involvement.

Given the decision to act, the city rather naturally decided to appoint a Board to study the matter. Citizen committees were becoming commonplace in Cambridge politics at the time, and there was nothing about the particular Board appointed to study DNA that was designed to meet the special needs of a technical controversy. Initially, the City Council envisioned a board of scientists; but the City Manager, whose task it was to appoint the members, decided a group of scientists would be too divisive, and settled on a group of lay citizens, geographically and ethnically diverse, with no previous connection to the DNA controversy. Thus, inadvertently, on strictly pragmatic grounds, he put the concept of lay involvement to the test.

As the issue proceeded to the citizens' Board, the ground rules continued to be set by the academic scientists and administrators. Following arguments from both proponents and opponents, the question before the Board was narrowly defined, that is, to assess the short-range health hazard posed by DNA and to stipulate adequate safety measures, clearly a technical decision to be made by considering technical testimony. Questions of long-range risk, benefit, and ethics were set aside.

Needless to say, some of the Board members found such a charge intimidating. Lacking a technical background, they felt ineffectual and foolish asking questions and discussing the issues before the scientists who testified, as they later explained in interviews. Each member's efficacy depended largely on his confidence in handling technical information. And confidence varied enormously, ranging from two physicians who quickly became vocal proponents of the research, and Sheldon Krimsky, a philosopher of science from Tufts who played "devil's advocate," to a nurse and a nun who hardly spoke at all. Everyone in the group looked to the two physicians for arbitration of technical difficulties, and to Krimsky to find any chinks in their armor. The Board, then, quickly developed a hierarchy of expertise, a skewed social dynamic, with only a few members participating fully. In particular, the women were at the bottom of the hierarchy; they had fewer professional credentials, a propensity for being deferential to male professionals, and a stronger interest in the ethical than the technical aspects of the debate. They were frequently admonished for diverting the group from the immediate health considerations in their charge.[11]

Under the circumstances, the Board felt most comfortable viewing itself as a citizen jury, a concept developed by Krimsky to help the group define its role.[12] The model fit well, allowing members to play a largely passive role, while opposing scientists argued their case before them. Several Board members reflected afterward in interviews that it would have been even better if scientist-advocates, the equivalent of opposing courtroom attorneys, had "cross-examined" scientist-witnesses on both sides while the Board viewed the process even more passively.

Like the City Council before it, the Board was forced to reach its conclusions on non-technical grounds. In discussing the factors that influenced their decisions, Board members most frequently mentioned the credentials of the scientists who testified (and prestige, position, and speaking manner). Board members noted that the proponents appeared cooperative and organized; the critics, distracted and disorganized. Again, the problem was partly the critics' ambivalence. Said one critic, "We did it in a haphazard fashion, all of us sort of feeling like our jobs were being compromised and our lives were being compromised. And so none of us put a great deal of heart into it."[13]

Partly because the Board selected witnesses on the basis of academic stature, proponents far outnumbered critics in giving testimony. Of 35 witnesses, 26 were proponents; 19 of the proponents were from Harvard and MIT. Harvard and MIT safety officers also worked closely with Board members informally, hammering out procedural details for institutional safety manuals and the like. In spite of a city-wide understanding that citizens' committees were to be free of lobbying, both Harvard's and MIT's community relations specialists sought to influence the Board in ways that several Board members felt were inappropriate.

In spite of these pressures, the Board's report was strikingly well-reasoned and cogent--thanks partly to an introduction drafted by Krimsky. The recommendations focused on monitoring the research, and made one technical modification to the federal guidelines (a change also introduced by Krimsky).

After being buffeted for a month by standard political forces, the report was then translated into a city ordinance. Ultimately, the City Council unanimously supported the ordinance but for markedly different and, again, non-technical reasons. The so-called "liberal" Councillors--elected from a slate endorsed by a coalition of liberal political groups in the city and tending to represent the academics' interests--were relieved that the report coincided with their own feelings on the issue, and led the fight to push through the legislation. The "independent" Councillors--generally more conservative and reflecting working-class interests--voted for the ordinance in order to get rid of the affair, concerned that the DNA issue was diverting the Council from issues with more voter appeal. Vellucci, after trying again for a ban on the research, reconciled himself to the ordinance on the grounds that it was better than nothing.[14]

The conservatives' instincts about voter interest were apparently correct. The following Fall (1977), when Councillors campaigned for re-election, there were virtually no questions or comments from voters about the issue that had dominated the last term of office; rather, concerns centered on neighborhood problems, and on rent control, condominium conversion, and the question of allowing restaurant customers to "brownbag" drinks.*

The greatest impact of the Cambridge process was probably felt not within Cambridge but in the U.S. Congress, where shortly after the city's ordinance was passed, a number of hearings were called and bills introduced in which a key issue was whether federal legislation should preempt city and state regulatory authority. Cambridge was cited in arguments for both sides: on the one hand, as a model for public involvement, and on the other hand, as a close call that must be prevented in the future. Partly to prevent similar conflicts in the future, several scientific organizations and universities (especially Harvard) lobbied heavily for federal preemption, until legislation reached a stalemate in Spring 1978.

And so the legendary Cambridge chimera appears to have been a relatively familiar beast, a combination of traditional lay and scientific regulatory mechanisms. Returning to the contradictory myths, we find that the problem is mainly one of exaggeration. The citizens neither exonerated nor condemned the federal research guidelines, and neither upheld nor repudiated scientific values. Given the limitations of time and technical competence, the citizens accepted both the scientific values and their regulatory product as a working basis for resolving more expedient details. Similarly, the lay process was neither swayed by a few extreme political or scientific critics, nor founded on the sentiments of the man-in-the-street. Within the limitations of the city's political structure and traditions, Mayor Vellucci was kept in check, scientist-critics expanded their influence only slightly, and the public was once again represented by the few who are active in city affairs. As Cambridge Councillor David Clem summarized in a Congressional hearing: "The Cambridge model is one example. It is probably not perfect or even adequate, but it is a beginning . . ."[15]

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* For reasons apparently unrelated to DNA, the election results were startling: four incumbents lost, including two conservatives and the two Councillors who had played leadership roles in the DNA issue. On the other hand, Vellucci made a stronger showing than in the previous election, in spite of a scandal about his misuse of his state tax department job.

NOTES

1. This paper was presented at the annual meeting of the Society for Social Studies of Science, Bloomington, Indiana, 4 November 1978, and is condensed from a more detailed study in progress. Author's address: Room 14E-310E, Massachusetts Institute of Technology, Cambridge, MA 02139.

2. For an analysis of some of the forces contributing to the escalation of the DNA controversy, see Dorothy Nelkin, "Scientists in an Adversary

Culture: The 1970s," Newsletter on Science, Technology, & Human Values, No. 24 (June 1978): 33-39.

3. Examples of praise for Cambridge as a decision-making model can be found in Maxine Singer, "The Involvement of Scientists," Research With Recombinant DNA, An Academy Forum, March 7-9, 1977 (Washington, DC: National Academy of Sciences, 1977): 30; in the transcripts of Hearings before the Subcommittee on Health and Scientific Research, Committee on Human Resources, U.S. Senate, Washington, DC, 6 April 1977 (especially remarks of Senator Edward M. Kennedy and Massachusetts Governor Michael Dukakis); and in Jonathan King, "A Science for the People," New Scientist (16 June 1977): 634-636.

4. This paper is based on documents and interviews collected by the MIT Oral History Program from members of the Harvard and MIT faculty and administration, the Cambridge city government, and the Cambridge Laboratory Experimentation Review Board; these materials are housed in, or being prepared for, the Institute Archives and Special Collections, MIT Libraries.

5. Recombinant DNA policy at Harvard in 1975 and 1976 had been shaped largely by a series of committee meetings and hearings organized within the Department of Biochemistry and Molecular Biology and the Biology Department, in consultation with the office of the Dean of the Faculty of Arts and Sciences.

6. Barbara Culliton, "Recombinant DNA Bills Derailed; Congress Still Trying to Pass a Law," 199 Science (20 January 1978): 274.

7. The tendency of scientists to seek ways to control public involvement is discussed in Harold P. Green, "The Recombinant DNA Controversy: A Model of Public Influence," presented at a symposium on Scientific Solutions & Human Problems, University of California, San Francisco, Continuing Education Health Sciences, 21 April 1978.

8. From transcript of interview; permission to quote by name not available.

9. From interview in preparation for archives; permission to quote by name not available.

10. From interviews in preparation for archives; permission to quote by name not available.

11. Difficulties encountered by lay citizens participating with scientific experts in policy decisions are described in Duncan Macrae, Jr., "Science and the Formation of Policy in a Democracy," 11 Minerva (April 1973): 228-242.

12. Sheldon Krimsky, Memorandum to the Cambridge Laboratory Experimentation Review Board, 2 September 1976. An evaluation of the Cambridge citizen board as a "citizen court," in contrast to a "science court," is given in Sheldon Krimsky, "A Citizen Court in the Recombinant DNA Debate," 34 Bulletin of the Atomic Scientists, No. 8 (October 1978): 37-43.

The contrast is also explored in Dorothy Nelkin, "Threats and Promises: Negotiating the Control of Research," 107 Daedalus, No. 2 (Spring 1978): 191-209.

13. From an interview with the author; permission to quote by name not available.

14. The Mayor of Cambridge is elected by the City Council from among its nine members. Vellucci, an independent, had won the mayorship the previous year by garnering the support of the four liberal councillors in exchange for his votes on certain key issues. The Council thus was split during the term between four liberals and four independents, with Vellucci frequently casting the deciding vote.

15. David Clem, testimony in hearing before the Subcommittee on Health and Scientific Research, Committee on Human Resources, U.S. Senate, on S. 1217 to regulate activities involving recombinant deoxyribonucleic acid and related bills, Washington, DC, 6 April 1977, p. 173.

PRESENT STRAINS IN THE RELATIONS BETWEEN SCIENCE, TECHNOLOGY AND SOCIETY*

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I

During the last twenty years and at almost every level of Western culture, signs of profound strain have appeared in the relation of science and technology to society. Sometimes this strain has taken the form of aggressive assertions of the superiority of feeling and intuition over logic and reason. In the climactic scene of the movie "Star Wars," for example, the hero deliberately turns off the computer-controlled system guiding his rocket and trusts his feelings to guide his bombing run on the enemy warship. In an extremely popular series of books, Carlos Castaneda offered an ostensibly documentary account of a social science graduate student's "de-programming" from his rationalistic and scientific mind-conditioning by a Yaqui Indian sorcerer, who showed him the world as it "really" was and as it could not be seen by Western science. In _The Tao of Physics_, physicist Fritjof Capra argued that the apparent anti-intellectualism of Eastern mystical religious philosophy in fact embodied a trans-logical approach to reality that is validated by quantum mechanics and quantum field theory. In _Against Method_, philosopher of science Paul K. Feyerabend denied that scientific thinking could, on available evidence, be shown to be constrained by a rational or logical methodology (e.g., the Baconian method). He called for an explicitly anarchic/Dadaist epistemology that would liberate students of science from the enervating myth of learning to reason methodically from empirical data to theoretical constructions.

Other signs of strain abound. A host of books that are critical (and, in the main, destructively so) of technology have received widespread acclaim since the late 1950's.[1] There have emerged, even within the scientific community itself, condemnations of certain lines of scientific inquiry as _a priori_ unscientific or simply forbidden, and calls for moratoria on research in certain areas. Not only have astrology, magic, and spiritism maintained their strength among traditional supporters, but their popularity has spread, marked by intense interest on the part of scientists in parapsychology, mysticism, and the speculations of Velikovsky, von Dãniken and others. Also relevant to this strain are the world-wide revival of religious fundamentalism and messianism and the proliferation of anti-rational authoritarian cults. Finally, the power of the consumer movement, the anti-nuclear movement and allied environmentalists, and the many supporters of zero-growth economics, all add to a sense of the pervasiveness of current criticism of the social roles of science and technology.

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How may we account for the appearance of these tensions in a society that, as recently as the early 1960's, seemed to accept science as the locus of what we could know about the world and accept technology as the vehicle for applying that knowledge to the advancement of human well-being?

It is tempting to blame developments within science and technology for these strains, and to claim that, by recent products and institutional affiliations, science and technology have revealed themselves to be unworthy of public trust and hope. Three particular indictments are presumed to indicate the moral bankruptcy of science and technology: indifference to the environmental impact of production (including the impact on people involved in production); participation in the development of fearsome armaments; and reinforcement of rampant consumerism. But this initially plausible account will not satisfactorily explain the appearance of these tensions during the last twenty years. No significant value judgments appear in the current critical literature that cannot be found in 19th and early 20th century literature, long before the allegedly "causal" internal developments occurred. In short, the salient points of current criticism have long been articulated forcefully and well, in particular during the course of the 19th century. Yet these earlier articulations did not provoke the broad public response that characterizes the current debate. It is thus appropriate to look, not at science and technology themselves, but at the cultural value context within which they are pursued, in order to discern what makes our culture responsive now to what it ignored before.

II

The most common theme of contemporary critics of science is that it is wrong to identify human well-being with technical, or even conceptual, sophistication, i.e., that it is wrong to see progress in knowledge of nature or in technology as privileged indices of human progress. Personally, I would agree with this claim, but it is hardly new. The early Hebrew prophets--for example, Isaiah--warned against the identification of personal well-being (the well-being that eventuates in salvation) with the work of one's hands, without thereby denying the superiority of comfort, health and prosperity to discomfort, illness and poverty, if righteousness is held constant. Certainly Socrates explicitly addressed this question when he criticized Anaxagoras for being concerned with the nature of the Sun (jeopardizing his life in the process) while still ignorant of his own nature as a person. Plato and Aristotle, from different directions to be sure, dealt at length with the error (to them) of supposing that technical mastery over nature, or scientific knowledge was a measure of truly human fulfillment. For Plato, a human being's proper "home" was in a supra-natural realm and any excellence in the realm of the natural was bound to be a potent seductive force luring the soul away from that home. For Aristotle, a human's highest act was abstract and purposeless thinking (i.e., thinking about thinking), emulating the fully-actual being that undergirds Aristotle's ontology. Technical mastery and even theoretical understanding of nature were merely steps on the way to the truly valuable states of mind that constituted fulfillment of the human condition. A vast literature from Hellenistic, Roman, Medieval, and Renaissance times (also from Islam, India, and China) links these ancient criticisms of science and technology as irrelevant to human advancement with analogous criticisms made during the Industrial Revolution.

In the 18th century, for example, three very different writers made penetrating analyses of the fast-maturing science and technology of their "modern" age. In *Gulliver's Travels*, Jonathan Swift relentlessly parodied the scientific researcher who begs support for his studies from everyone within earshot, promising vast social benefits from projects that are clearly personal obsessions and (equally clearly) hopelessly misconceived and manifestly sterile. In *Émile*, Jean-Jacques Rousseau argued that technology was a major obstacle to the realization of human well-being, alienating humanity from the Nature within which human nature necessarily unfolded. In his epic re-creation of the Faust legend, Goethe created a hero whose passion to comprehend the fabric of reality led him to compromise his most elementary values and jeopardise his immortal soul. Faust longed "to detect the inmost force, that binds the world and guides its course, all germs and forces to explore" and so "the bitter task forego of saying the things I do not know." As had Swift, Goethe sensed the *personal* passion behind the profession of *social* benefit that underlay science and technology.

At the height of the first Industrial Revolution, side by side with the myriad tracts that extolled the power of machinery to eliminate negatives in the human condition and promised to convert earth into heaven and people into something approaching angels, there were also cogent arguments that all these promises were based on erroneous interpretations of human nature and its relationship with external nature. Henry David Thoreau, for example, gave particularly acute expression to one problematic feature of technology in his review (1843) of *The Paradise Within Reach of All Men, Without Labor, by Powers of Nature and Machinery*. Thoreau contrasted the attitudes of the ethical philosopher (that is, the philosopher of ethics) and the mechanical philosopher toward humanity's relation to nature. The former believed that if "he will reform himself. . . .then nature and circumstances will be right," while the latter believed that if one can "reform nature and circumstances. . . .then Man will be right." Until recently, Western society adopted the mechanician's approach and rejected the ethician's. Now the question of which approach is correct, or of what balance between the two is most valuable, has again come up for discussion. Characteristically, today's discussion is not placed in an historical context that exposes how central perennial value judgments are to choosing between these approaches. Rather, the discussion treats the choice of approach as a consequence of the unique current state of affairs.

Shortly after Thoreau's review appeared, Robert Dale Owen, son of the utopian English socialist-industrialist reformer Robert Owen and heir to his father's ideals, called attention to another puzzling feature of the exploitation of technology: "Mechanical improvements, inevitable even if they were mischievous, and in themselves a rich blessing as sure as they are inevitable--are becoming by some strange perversion of their use, a cruel and deadly curse." Owen wrote this in 1848. Half a dozen years later, the United States government could no longer avoid legislation regulating the manufacture and operation of steam engines. In London in 1855, a public scandal followed a physician's exposé of the use of harmful additives by commercial food processors. Concurrently, devastation of large sections of the English countryside by air pollution from manufactories (for example, in the Midlands) soon forced passage of the Alkali Works Regulation Act (1864). A contemporary account in the journal *Chemical News* noted that regulatory legislation was inevitable because, without it, toxic pollutants were apparently controlled only where public outcry was intense. Manufacturers claimed that they could not meet the mandated control standards and that regulation would threaten the general prosperity; these claims, the journal noted, were, in fact, proving groundless. In the United States, also in the 1860's, there were warnings that industrial pollution along the Schuylkill River threatened Philadelphia's domestic water supply. Thirty years of municipal controversy ensued, ending without any attempt to control the polluters, but with a plan for building the best *filtration* plant technology could provide, thereby evading the political challenge of writing and enforcing pollution-control legislation. As in the Midlands, Philadelphia manufacturers argued that they were the basis of the area's prosperity, and that harassment could undermine this prosperity, resulting in much poorer people who would have much cleaner water to drink.

In *The Coal Question* (1865), the English physicist Stanley Jevons addressed still another problem confronting a society whose prosperity was based on high-level technology. Jevons argued, with uncommon attention to statistical data, that England's coal-based high-technology economy would, in spite of apparently enormous coal reserves, soon be strained to the point at which England could no longer favorably compete with foreign manufacturers. People had been misled into thinking that England's coal supply was inexhaustible. They were paying no attention to the rate of increase in coal consumption and to increased costs of obtaining that coal from ever deeper mines. Jevons further argued that the recent adoption of petroleum as a fuel would not materially affect his conclusions because it, too, was only a finite resource and because England would have to compete for it with other nations, thereby losing the cost advantage conferred by burning domestic coal. England, he concluded, could expect to sustain prosperity based on high-technology for no more than 200 years, and perhaps considerably less, even if petroleum turned out to be a major fuel in the future. Jevons attempted to sketch both the style of social life that would stretch the coal supply and the type that would result if the supply were rapidly depleted. Both scenarios removed England from a position of influence in world affairs. The nation, Jevons argued, had to choose "between brief greatness and longer continued mediocrity." There was, he thought, a good deal to be said for brief greatness, not merely as an expression of English vanity, but for its value to all the world. "No part, no function of a nation is independent of the rest, and in fearlessly following our instincts of rapid growth we may rear a fabric of varied civilization, we may develop talents and virtues, and propagate influence which could not have resulted from slow, restricted growth, however prolonged." A governmental commission of inquiry, convened in the wake of critical response to Jevons' book, concluded that his predictions were unduly pessimistic, that all was well, and that nothing need then be done or feared.

By the end of the 19th century, scores of World's Fairs, national and international industrial and scientific exhibitions, expositions and congresses had trumpeted the imminence of earthly salvation evident in these manifest triumphs of society. Henry Adams, in his essay "The Dynamo and the Virgin," reflected on his visit to the Paris Industrial Exposition of 1900, accompanied by the American physicist Samuel Pierpont Langley. Adams had stood dumb-struck before the electric dynamos. Although Langley characterized them as merely "ingenious channels for conveying somewhere" the energy latent in coal, Adams, who was almost totally ignorant of natural science, demurred. For Adams, the dynamo was a clear "symbol of infinity," a "moral force," "the most expressive symbol of ultimate energy." The dynamo reminded him of the Virgin Mary and caused him to reflect upon how hopelessly shallow were American notions of symbols. In the Middle Ages, he wrote, the Virgin was by no means a passive symbol of faith. She was a moving force, the dynamo of that time, one that had powered the construction of all of the great Gothic cathedrals, in consequence dedicated to her. Adams was convinced that the technological dynamo was a similar force that would generate characteristic constructions in the new 20th century. What would those constructions be? Adams did not know, but his tone was distinctly pessimistic.

After describing recent developments in atomic physics and the possibility they could result in explosives that would dwarf TNT, English physicist Frederick Soddy, home on leave from the "war to end all wars," asked his audience to "imagine. . .what the present war would be like if such an [atomic] explosive had actually been discovered instead of being still in the keeping of the future." Its discovery "conceivably might be made tomorrow, in time for its development and perfection for the use or destruction, let us say, of the next generation, and which it is pretty certain, will be made by science sooner or later." From the side of science and technology in other words, the development of atomic energy was virtually inevitable in Soddy's opinion. The question that was still open in 1915 was whether it would be for the use or for the destruction of the generation that would play host to that development.

III

The political and intellectual antagonisms to science and technology that reappeared in the 1960's and 1970's were not based on abstract moral and philosophical principles as ancient and classical criticisms were, but were tied directly to existential problems already being posed by the new technology: large-scale unemployment, noise, air and water pollution, harm to and alienation of workers, disruption of harmonious relationships among small units of people or between people and nature, and so forth.

What underlies the spread today of attitudes that did not spread earlier? Note the new thrust of this question. It is no longer a matter of accounting for a current discovery that science and technology are problematic. Rather, we need to understand how acquiescence in age-old perceptions of their problematicity is symptomatic of a broader, much more fundamental value shift in our culture, one with which the values embedded in science and technology are no longer concordant. I would like to point briefly to three cultural phenomena that may illuminate the value shift which has, for many, isolated science and technology from questions of human development.

(1) Identifying progress in science and technology with human progress is clearly part of the rhetoric of the idea of progress itself. As long as there was widespread public conviction that human progress was not only possible but was in fact taking place, then the manifest advances of science and technology could naturally be taken as authentic indicators of human progress. We now know that those who, in the 16th and 17th centuries, defended the reality of progress in the popular public debates of the time were ultimately acknowledged right and those who denied progress, wrong. Francis Bacon, for one, rode to fame as "father" of modern science on the back of the progressivist faction, largely Puritan. The Puritans, partly because of messianic convictions, were strong progressivists who reformed the English educational system to reflect this, initiating a chain of events not unrelated to the founding of the Royal Society.[2] Today, the idea of human progress is itself up for revaluation. In its train, it draws down for revaluation the human implications of advance in science and technology. It has suddenly become commonplace to deny that significant progress in being human has taken place during recorded history, and much criticism of science and technology is directed precisely to this end. Nothing essentially human, it is claimed, advances through acquisition of technique or the elaboration of enormously complex and abstract (that is, removed from common experience) theories that supposedly demonstrate that we "understand" the world in which we find ourselves. Thus there is a turning from knowledge, pursued in universities, laboratories, and books (pursued, that is, in the heart of "advanced" civilization), to wisdom, sought from sages, gurus and saints living primitively, in both a conceptual and technological sense. When one denies that truly human progress has occurred in the course of Western cultural development, two conclusions relevant to science and technology seem to follow: advances internal to science and technology are no longer taken as authentic indicators of human progress; rather, these advances suddenly become interpretable as potent seductive forces, to be forcefully opposed, as Plato had already foreseen.

(2) One feature of recent Western intellectual history has profoundly reinforced the preceding line of thought, namely, the undermining of classical notions of objectivity and rationalism, beginning with the formulation of non-Euclidean geometries in the mid-19th century. The central implication of non-Euclidean geometries for the rationalism that had dominated Western intellectual history ever since classical antiquity was its severing of any necessary connection between logic and ontology. From Pythagoras and Parmenides to Hegel, it was axiomatic for all but a handful of philosophers that there was the most profound connection between thought and reality, a connection that was secured in the case of syllogistic thought and exemplified in the theorems of Euclid's Elements. That alternative (and exclusive) axiomatisations of geometry are possible, makes it impossible to proclaim confidently that deductive inferences even from true premises are truths about reality independent of the human mind. In short, ontological inferences can no longer be based solely on logically necessary reasoning, as was the case, for example, with Descartes, Spinoza and Leibniz.

It is unfortunate that the development of non-Euclidean geometries is so often taken to be a development internal to the historical development of mathematics and is not appreciated as a fundamental development within Western culture. Coordinate with this revolutionary undermining of rationality in mathematics was an added and complementary undermining of the objectivity of mathematical modelling in the sciences, so that by the late 19th century it was possible, and even common, to claim that scientific theories were in some essential measure arbitrary constructs of the human mind and not simply revelations of the structure of the external world.[3]

I have elsewhere[4] argued that, at least since the mid-19th century, Western literature, art and music have increasingly reflected a rejection of the claim that objectivity and canonical rationality are privileged routes to truth. Henri Bergson began a systematic philosophical defense of this rejection in the late 19th century, one that was destined to become an intellectual analogue of activities in symbolist poetry, stream of consciousness novels, atonal music, and post-Impressionist art. The "sudden" passion today for parapsychology, mysticism, intuition, Eastern philosophy, "other states" of mind, fundamentalist religions and rejection of the products of science and technology as indices of human achievement is less startling, less "sudden," when viewed against the horizon of these cultural phenomena.

(3) The emergence of medical ethics as an area of intense public interest and as a new scholarly discipline reveals something of the roots of current criticism of science and technology. In medical ethics, we often find the facile claim that medical technology is the root of a new crisis in health care, and that medical science has nothing positive to contribute to its resolution. To me, however, this "crisis" is not at all new and only reveals that medical technology has made it impossible for people to continue to avoid perennial value questions central to human existence, value questions which the masses of humanity have "successfully" avoided for all of recorded history: for example, what is life; what is death; when is life; when is death; what is the nature of authentically human existence; what is health; what are the relative obligations and rights of patients, physicians, societies? No current medical-ethical issue of significance is truly a consequence of current technology. These issues are, however, forced upon our attention by medical technology and in the process we must acknowledge that, the persistent cries of physicians, philosophers and theologians notwithstanding, we have chosen for millennia to ignore these questions, largely for lack of any practical choice in the matter. As medical science and technology continue to present new choices, we are unable to choose and so lash out at the "moral bankruptcy" of the science and technology that we feel placed us in this position.

* * *

The current literature critical of science and technology emphasizes the capability of science and technology for generating social problems that we are at a loss to resolve. It seems, however, far more correct to say that the increased leisure, prosperity, freedom, and power provided by science and technology are now forcing us to grapple with perennial value questions that a meaner existence had relegated to the province of abstraction. A generic feature of human nature that emerges from consideration of the three phenomena discussed above is our unwillingness to confront value questions unless confrontation is forced upon us by concrete contexts of experience. The sudden popularity of medical ethics exemplifies this especially well. Thus, an informed awareness that science and technology raise profound personal and social value questions has existed for at least 2500 years, yet contemporary critics insist upon channelling the responsibility for the anxiety generated by these questions onto specific theories and machines. That is, they insist upon placing the responsibility on external features of the human environment instead of seeing this anxiety as a projection of an internal feature of that environment, one to which psychology and sociology are as relevant as political action.

NOTES

1. Let me just name what seems to me to be a representative selection of the more prominent books that I have in mind: John Kenneth Galbraith's The Affluent Society, Rachel Carson's Silent Spring, Ralph Nader's Unsafe At Any Speed, Vance Packard's The Hidden Persuaders, C.P. Snow's The Two Cultures, Jacques Ellul's The Technological Society, Alvin Toffler's Future Shock, Theodore Rozsak's The Making of a Counter-culture, Charles Reich's The Greening of America, René Dubos' So Human An Animal, Dennis Meadows' The Limits To Growth, E.F. Schumacher's Small Is Beautiful, Lewis Mumford's Pentagon of Power, Joseph Weizenbaum's Computer Power and Human Reason, Ivan Illich's Medical Nemesis. To be sure, these books differ wildly from one another, in tone, in the sense that they make, and in what they claim, but all are profoundly critical of the functioning of contemporary technology.

2. Comenius, the great Czech thinker whose Moravian Church had much in common with the Puritans and who was consulted by them, warned that if the new philosophy of nature did not consider the ends to which knowledge was to be put as legitimately within its purview, then such an organization as the Royal Society was as likely to lead to a Babylon on Earth as to a Heaven.

3. Prominent representatives of this interpretation of science in the 19th century include William Whewell, Auguste Comte, Claude Bernard, Ernst Mach, Heinrich Hertz (see the introduction to his Principles of Mechanics), Pierre Duhem, Henri Poincaré and Émile Meyerson. More recently, this view has been developed dramatically by Jean Piaget and argued by Thomas Kuhn, Michael Polanyi, Norwood Hanson and Paul Feyerbend.

4. S.L. Goldman, "The Metaphysics of Objective Reason," 1 Science/Technology and the Humanities 3 (Fall 1978).

ON A STRATEGY FOR USING THE ELECTRONIC MEDIA TO IMPROVE THE PUBLIC UNDERSTANDING OF SCIENCE AND TECHNOLOGY*

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In the brief span of two generations, television and radio have become the dominant news and entertainment media of American society. More than 200,000,000 people--practically all Americans over the age of two years--are television viewers. The Nielsen Television Index for 1978 indicates that for the last five years the average household has had at least one television operating for six hours of each day. Although most Americans use television primarily for entertainment, as an escape into an electronic world of drama and comedy, a growing number rely on the electronic media for local and national news. The combined ratings of the network evening news programs on commercial television are now estimated at 40% of the nation's television households. In fact, a 1976 Roper poll found that 40% of the American public depend solely on television for their news and current events information. If we include those who receive their primary news from television and radio (supplemented by newspapers and magazines), the Roper poll indicates that 80% of the public tune in to the world by way of the electronic media.

These statistics emphasize the importance of the electronic media in any attempt to make science and technology a more understandable part of everyday experience and educational activities; but the statistics must be used with caution. For better or worse, American television is not first and foremost a news or educational medium.[1] It achieved its dominance by developing production techniques that hold a viewer's attention sufficiently well to guarantee an audience for the advertisements. The national commercial television networks, which evolved directly from the national radio networks, have burgeoned into a multi-billion dollar business funded by advertisers who believe that network television is the best selling medium yet devised. As a result, the 30-second and 60-second commercial messages are television's most fully developed art form.

This marriage of the sales mentality to the electronic image has led to a form of psychological conditioning of the mass audience. Producers have learned what formats, production techniques, symbols, and personalities are most likely to succeed in the home marketplace. The audience, on the other hand, is accustomed to television's short bursts of entertainment and glossy information. Combining this format with the even briefer, more intense commercial advertisements builds a distorted impression of life and blurs the distinction between image and reality.

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* Adapted from a paper presented at the U.S.-Japan Survey Seminar on Science and Society, Honolulu, HI, 1 February 1979.

It is not surprising that the predominant content is light entertainment with a minimum of serious, public affairs coverage. This is not a totally evil result--after all, people have been seeking escape from everyday cares since the beginning of human societies. However, in developing a strategy that uses the electronic media to improve public understanding of science and technology, it is important that we understand the process by which American life styles have been mediated.

Resonance

In his book The Responsive Chord,[2] Tony Schwartz contends that the electronic media utilize a patterning of information based on the resonance principle in communication. A listener or viewer brings an enormous amount of information to the communications event, but this information is almost latent by print media standards and is not easily evoked by such stimuli as a print media questionnaire. A communicator preparing an electronic message must understand the kinds of information and experiences stored in the minds of the audience, and then pattern the new information or educational material so that it "resonates" with the information already stored.

In effect, the electronic media do an end run around mental processing of printed words and use auditory-visual stimuli to evince holistic responses that are different from those obtained from print media. Schwartz cites the following example:

> The evoked recall process is similar to the experience of seeing an automobile accident. In witnessing an accident you hear the squeal of brakes, the crash of the car, and possibly see a person bleeding. At a later time, should you hear the squeal of brakes you may also recall many of the sights, sounds, feelings, and associations you experienced earlier. You will recall the event instantly, and this recall will form part of the context that gives meaning to the present stimulus.[3]

Based on his experience in the electronic media and his analysis of audience effects, Schwartz concludes that television, like radio, is an auditory-based medium. He believes that watching television makes our eyes function as ears because the television image, like sound, is truly ephemeral. Our brains must make connections between fragmented images that appear on the scan lines of the television screen, much as sound waves must be connected to create words.

To achieve resonance, radio and television formats develop along formulaic lines and provide the basic pattern and structure within which characters and ideas are developed. These characters are, in turn, based on the stereotypes and shared fantasies of the American public. Those that "work" (i.e., resonate) are retained; those that are too complex or unpredictable are discarded. It is within such formulaic constraints as situation comedies, detective action dramas, commercials, and, most recently, the "happy talk" newscasts, that information and opinion on all aspects of life are communicated to the American audience.

Herein lies the dilemma of science communication. The vast majority of the television audience is unfamiliar with scientific symbols and basic concepts, so program material must be packaged in terms and symbols that do evoke resonant responses in the audience. When this is not achieved (i.e., dissonance), a program can elicit a confusion of thoughts and images that leads to boredom or anxiety. To achieve resonance, program pacing is frequently slowed down, and the imagery becomes so simple that the audience reacts negatively to the program's pedantic element.

In the contemporary media environment of quick-cuts, aphorisms, and spot announcements, it is easy to forget the enthusiasm educators and newspeople had for television once it became technically feasible. Art and science programs, television drama, and in-depth reporting were common in the early days of the medium, but the "dissonant" nature of many aspects of the sciences (and arts for that matter) did not always attract audiences. Too few viewers (or producers) understood or appreciated scientific concepts and processes to make it possible to achieve resonance with a commercially significant audience. Thus, to most television producers, the possibilities for meaningful science news coverage or educational programming appear to be severely constrained by the limited resonance potential for most of the audience.

Network television coverage of the U.S. manned space shots, for example, was designed to resonate with the American spirit of competition, exploration, and pride in technical achievement, and not with a national curiosity about the nature of the lunar surface or other scientific questions. Under the tutelage of Walter Cronkite and other newscasters, Americans became conversant with astronaut jargon and vicariously experienced Neil Armstrong's first steps on the moon, but they quickly lost interest in the scientific aspects of the Apollo project. Yet because the basic terminology and symbols of the space effort are now familiar to many Americans, the potential for learning about some scientific fields has been enhanced.

Increasing sophistication and a growing awareness of television's potential for developing resonance patterns for communication create opportunities for significant improvements in science programming. For example, in 1975, an excellent National Geographic Special on the human body, "The Incredible Machine," was highly promoted by its underwriter (Gulf Oil Corporation) and received not only critical acclaim, but also an enormous audience by public television standards: 20 million people (16% share of the audience). The PBS "Nova" series provides additional evidence that a sizeable viewership will tune in to science programs. Typically, Nova attracts a 5% share of the audience; when well-promoted, that figure can double.

Commercial television would find these numbers unacceptably low for a prime time program, but the ratings are high enough to encourage further experimentation. Presently, science on commercial network television is limited to nature shows (e.g., "Wild Kingdom") and occasional news specials on science-related issues. There are only a few science reporters on national television and occasional efforts by local commercial stations to cover science news regularly. Most important, there are no major science production groups in the network news departments.

The popularity of science on public television, and a recent expansion of science-oriented publications in the print media[4] may have stimulated some activity in commercial television. CBS News, producer of the popular "60 Minutes" videomagazine (which occasionally includes segments on science/technology issues), is currently planning to broadcast this spring a pilot science news weekly. However, I would hasten to balance this optimism with some realities. "Lifeline," a series of real-life medical documentary dramas shown in Fall 1978, was technically well-done but not retained by NBC because of low audience ratings. The relatively low ratings for science programming (even of "Nova" quality) will, in most cases, force producers, especially those without previous experience in science television, to search for formulas that can achieve resonance with the largest possible audience. The resulting programs may be oriented more towards entertainment than information or education.

A Strategy

Any strategy to use the electronic media to improve public understanding of science and technology must involve a long range plan and objectives. It should come as no surprise that I favor a multi-faceted approach emphasizing the public media, recognizing that commercial television and radio, when convinced of the audience potential for science, will respond with their own programs. Efforts to establish science news and documentary production units in both public and commercial broadcasting should be supported by the scientific community and interested lay persons. Since producing science programs for television and radio requires more trained science producers and more advisers than are presently available, communications and journalism schools should be encouraged to create special educational programs for scientists and communicators interested in the electronic media.

To create a large audience for high-quality science programming, we must, however, also recognize some existing limitations. In a recent survey, conducted for the NSF, J.D. Miller of Northern Illinois University found that the portion of the young public "attentive" to science is still small, at 1% of the non-collegebound high school students and 25% of the college students. That 25% further subdivides into 7% attentive to science, per se, with the remainder interested in science as it relates to political, economic, or social issues. Professor Miller, who focused on news and information related to science-oriented issues, characterizes the problem of communicating to these different publics as follows:

> . . .our study of the attentives and non-attentives for organized science suggests that the two groups have very different information needs and it would appear that we are inadequately responding to those differential needs presently. For the attentive public,

> we have a group of people who are already interested in organized science, who have a certain level of information, and who make an effort to acquire additional information. This group needs a more sophisticated information flow that candidly discusses the benefits and risks of various policy alternatives and that encourages open debate among the members of the scientific community. We have very little of this kind of communication available today. In contrast, the non-attentive public lacks interest and would be highly unlikely to consume more sophisticated information were it available. Messages targeted to the non-attentive public should be persuasive in nature, seeking to stimulate interest first. Too often, in my view, messages directed to the general public contain primarily non-sophisticated information, which serves the needs of neither group.[5]

To a certain extent I would dispute this last contention, at least as it relates to national public television and radio, which already provide an invaluable service to the science "attentives". Here I need only cite that, in addition to the National Geographic Specials, and BBC Science Profiles (e.g., "Marie Curie" and "Einstein's Universe"), several exciting new series will be aired in the next few years. Carl Sagan has joined with Adrian Mallone and KCET-TV (Los Angeles) to produce "Cosmos," a guide to study of the universe. Mike Ambrosino (originator of "Nova") is assembling "Odyssey," a series of documentaries on anthropology and archaelogy. A third BBC series, to be shown on PBS stations this fall, is "Connections," which focuses on inventions and technological creativity. Ira Flatow, science reporter for National Public Radio, is currently developing ways to expand NPR's science coverage.

There are, however, major weaknesses in science programming which should be (and, in some cases, are being) addressed. First (and easiest), the existing program material must be better promoted to increase public awareness that science programs are available.

Second, and perhaps most important in the long range, the need to increase the size of the "attentive" audience requires special educational efforts using television. NSF and other sponsors have funded production of a new children's science series by the Children's Television Workshop (producers of Sesame Street and Electric Company). Scheduled for early 1980, the public television series is targeted at the critical age bracket, 8-12 years, in which science anxiety and avoidance behavior often take root. Using a video magazine format, the CTW series will attempt to increase the child's scientific curiosity and develop positive attitudes towards the study of science and technology. The NSF Public Understanding of Science Program also recently funded production of a series of 90-second science spots to be made available for local news broadcasts. Developed by Don Herbert (the former "Mr. Wizard"), these segments are targeted at an adult audience.

Professor Miller's survey findings seem to point to a special, additional role that can be played by public television and radio. The

Miller study identified a small but important sector of society who want to enrich their lives with information about events in science and technology. They are the mobilized public who will become involved in policy debates and public interest groups. For science to develop a more interactive role in our culture, authoritative programs that focus on science/technology news and policy analysis should be provided to the attentive public via PBS, regional television networks, and local public stations. A greater effort should also be made in the area of international cooperative projects with science production units in other countries (e.g., the Science and Industrial Program Group at the Japanese public network, Nippon Hoso Kyokai).

As project director of "Synthesis,"[6] a series of half-hour television documentaries on science-related policy issues in the Western United States, I have come to understand the need for a strong cadre of science producers, writers, and reporters willing to do in-depth television reports on controversial issues. To make such reporting successful, advisory input from disinterested academics, scientists, and policy analysts can create an atmosphere of critical analysis that can be incorporated within television programs while still retaining the sense of human intimacy that gives the medium its power. The prejudice against television often present in these three groups can be best combatted by demonstrating that science broadcast journalism can be developed within a responsible, permanent framework that includes their direct participation. To this end, a number of public television stations are exploring the concept of a weekly science news program that periodically includes in-depth policy reports. While such an effort would be aimed at the "attentives," it could establish a science news communications environment that could eventually result in upgraded science coverage on the commercial networks. If we can provide the public with more opportunities to develop improved comprehension and appreciation of science principles, processes, symbols, and people, we can increase the opportunities for meaningful resonant communication via the electronic media.

NOTES

1. Of the top 15 national television programs in the 1977-78 Nielsen survey, CBS' "Sixty Minutes" was the only public affairs program on the list. The first four in the rankings (and 10 of the top 15) were situation comedies. While many people watch the news programs and occasional documentaries, American television viewers seem to use television primarily to escape everyday cares.

2. Tony Schwartz, The Responsive Chord (Garden City, NY: Anchor Press/Doubleday, 1973).

3. Ibid., pp. 69-70.

4. Some examples of the print media awakening to a popular science reader ship are: The Science Times section of The New York Times (Tuesday edition); Omni, the new popular science magazine; Science '79, under consideration by the AAAS; and continued success of specialty magazines such as Oceans, Human Nature, and Psychology Today. There is also the possibility that Time-Life will enter the field with a "science

illustrated" format publication.

5. J.D. Miller, "The Attentive Public for Organized Science: An Application of the Selective Attentiveness Model." Presented at the American Association for the Advancement of Science 1979 Annual Meeting, January 1979.

6. "Synthesis," centered at KPBS-TV in San Diego, is presently being produced by a consortium of three Western public television stations: KPBS-TV, KWSU-TV (Pullman, WA), and KAET-TV (Phoenix, AZ).

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COMMENTARY: SCIENCE ON JAPANESE PUBLIC TELEVISION--AN ADAPTABLE MODEL FOR THE U.S.?

Marcel Chotkowski La Follette

At the recent U.S.-Japan Survey Seminar on Science and Society,[1] discussions on public understanding of science returned again and again to the importance of television, particularly public television, as a vehicle for communicating science to society. Japanese public television devotes considerably more attention to science and technology than does its American counterpart. Moreover, for over twenty years, the viewer-supported public broadcasting corporation in Japan has maintained an active science production group that develops programs often viewed by as much as 19%-24% of the potential audience (a share equal to that of popular non-science programs). These significant differences in the amount of science shown on public television and the way in which the audience for science is defined in the two countries led to the following general comparison of the two systems and some comments on possible areas for change.

Network Organization and Program Development

The first Japanese television network was established in 1953; the educational network in 1959. Although television channels in Japan are owned by the government, the media are regarded as representatives of the public interest rather than communications vehicles for the government.[2] Japanese public (i.e., non-commercial) broadcasting is represented by Nippon Hoso Kyokai (NHK), a public service radio and television network of two television channels (general and educational) and three radio bands. The network, like the British Broadcasting Corporation, is funded entirely by a dedicated tax on television receivers, a system that allows independence and provides a relatively stable and predictable source of funding.[3] It also coexists and successfully competes with the four national commercial networks.[4] In Japan's centralized, consensual, and highly literate society, the NHK has become a national institution; its general and educational channels now reach the entire country.

NHK has an identity unmatched in the U.S., where viewers are far more likely to identify with a particular local station (e.g., WGBH-Boston, KQED-San Francisco) than with either the Corporation for Public Broadcasting (CPB) or the Public Broadcasting Service (PBS). There are over 280 U.S. public television stations licensed to more than 150 entities (colleges, public school systems, states, municipalities, and independent non-profit corporations) by the Federal Communications Commission. Under the Public Broadcasting Act of 1967, the CPB was established to receive funds from Congress and dispense them to other entities (primarily PBS and National Public Radio) to develop and promote programming. The CPB originally intended that PBS be a program distribution and interconnection service; instead it has evolved into a membership organization that, in effect, represents the collective interests of the member stations and has a "separate and distinct existence" from CPB, which now acts largely as a conduit for funds.[5] Critics maintain that this situation leaves public television "saddled with localism" in both editorial sovereignty and revenue,[6] subject to Congressional review of appropriations that must be matched by private funds, and further subject to the scheduling preferences of PBS station executives.

In Japan, NHK produces its own programs, sets the schedule of broadcasting and, therefore, can make decisions on the basis of a policy that can take into account national needs and interests.

In the United States, at the first of each year, PBS affiliates examine a "shopping list" of series that will be available for broadcast in the following season. Production of some of these programs may have been funded by corporations or foundations, but others require full or partial funding from the stations, which choose programs in a series of voting rounds and then pool their budgets to "purchase" productions they could not otherwise afford. This system, the Station Program Cooperative (or SPC)[7] is a remnant of Nixon era efforts to decentralize PBS.[8] As stated by the recent Carnegie Commission on the Future of Public Broadcasting: "The SPC evolved as a program-by-program market place that insulates program decisions by giving power to several hundred station representatives, rather than a handful of centralized funders."[9] The SPC, however, accounts for less than 40% of all PBS station broadcasting. Within an individual station, proposals for new programs must be developed and then held until underwriting can be obtained.[10]

The new children's science program being developed by Children's Television Workshop[11] has, for example, run the gauntlet of this cycle of proposal development and search for production funding. In the case of this independent production center, the process involved extensive commitment of staff and resources prior to a formal proposal in October 1977; the series must also successfully compete in the SPC system and will be first shown in 1980. In contrast to this lengthy process, in commercial television, program ideas can originate within the organization that will both produce and broadcast the show, and decisions on format, scheduling, and promotion are made as part of overall network policy. Whether or not a pilot becomes a regular series is largely determined by identifiable and interrelated forces, audience reaction and sponsor interest. In the commercial system, this process of decision and development can take place in a matter of months rather than years.

Scheduling and Program Content

Most NHK science programming is produced by the Science and Industrial Program Group, one of seven subdivisions of NHK's Education Department. The Group's fifty staff directors (many of whom have science or engineering degrees) produce sixteen weekly television and four weekly radio programs and develop about fifteen additional "specials" each year. In 1978, for example, science programs broadcast on the educational (ETV) and general (GTV) channels included:

Channel	Title of Program	Day of Week	Length (Minutes)	Audience Share (%)
GTV	Ultra Eye	Monday evening	30	10-18
GTV	Nature Album	Sunday morning	15	10-15
GTV	Science Document	Monday evening	30	5-8
GTV	Today's Health	Mon. or Sat. morning, repeat afternoon	20	1-3
GTV	NHK Special Program (about 10 programs/yr. on Science)	Monday evening	50	10-19 (Max. 24)
ETV	Modern Science	Wednesday evening	45	1-2
ETV	Science for Everybody series	late afternoon	30	0.5-1.5
	(1) History of Technology	Monday		
	(2) My World	Tuesday		
	(3) Exploration into Nature	Wednesday		
	(4) Pleasant Laboratory	Thursday		
	(5) Science Topics	Friday (each show repeats at noon, next day)		

On the general channel, "Nature Album" has been broadcast for over 15 years and maintains a strong share of the audience; the series "Today's Health" is over five years old and yet, by most U.S. television standards, attains only an insignificant share.

On the educational channel, "Science For Everybody" features a different topic each week day and is re-broadcast each day at a time convenient for school use; "Modern Science" is a series of 45-minute documentaries that emphasize current trends in science and technology and their relevance to Japan. The science specials produced by NHK and shown on Monday evenings have occasionally been viewed by 24% of the potential audience [in contrast, successful "Nova" broadcasts have reached, for example, 6% of the New York audience[12]]. The NHK's coordinated approach to science means that a program such as "Today's Health," which reaches a relatively small audience, can be maintained in the schedule to provide needed information for a small segment of society. On the other hand, the more popular science programs demonstrate NHK's willingness to respond to the tastes (as well as the needs) of a large audience.

There is no central science programming group or office in U.S. public broadcasting. The strengths of the U.S. programs are wholly due to individual station production groups, which are, in turn, dependent upon corporate, government or private foundation funding. If coherent policy is set for these programs, then it must come from either the individual producers (who are not necessarily scientists) or the underwriters; it does not come through any existing formal links to the scientific community. Advisory panels, such as that used effectively by KPBS' Jeffrey Kirsch (see preceding article), are rare, are selected and controlled at the station level, and are frequently quite informal.[13]

Audience Definition

In a recent Daedalus article, television producer Anthony Smith remarked that "throughout the history of the mass media the audience has bewildered the communicators much more than the reverse."[14] Perhaps the NHK seems comfortable with the wide disparity in the ratings and types of audiences for science programs because it has recognized that its television audience is not monolithic. At the U.S.-Japan Survey Seminar, Yoshio Sunobe,[15] Chief Director of the NHK Science Programming Group, stressed that "in producing a science program, it is essential for the director to grasp accurately for what purpose the audience seeks information from the program and [to] classify the audience accordingly." Some members of an audience, he said, will seek information for their personal interest or welfare; others will seek it out of social interest. Moreover, the scope of interest and the quality of information that viewers want to obtain from a science program differ, depending on the individual's circumstances (time, place, situation). Dr. Sunobe described his view of the differing audiences for science:

> "Group I - Informational Needs Based on Social Interest:
> (a) Those who are deeply and directly involved in science and technology and who want rather professional knowledge and information.
> (b) Those who are in socially important positions and seek information useful for the judgment of scientific and technological problems from a broader political, economic and social point of view.
> (c) Those who are bound to be affected by the social changes taking place as a result of scientific and technological progress and who, as individual citizens, wish to know the latest scientific trends and ways to cope with them.
>
> Group II - Informational Needs Based on Personal, Internal Interest:
> (a) Those who wish to broaden and deepen their views on life and the world.
> (b) Those who seek the "unexpectedness" to be brought about by scientific and technological progress so as to satisfy their intellectual curiosity.
> (c) Those who seek practical knowledge, for example, on medicine."

"As a mass communications medium," Sunobe concluded, Japanese television "is mainly directed to Group I(c) and Group II(a), (b), and (c)."[16]

The difference between this approach and the two major audience/content models used by American public television is quite striking. The argument for what has been termed the "conspicuous excellence" model assumes that if the programs are of high quality and are "properly scheduled and promoted, [then] appropriate audiences will follow."[17] The other common model, that of "serving specialized audiences," begins by defining the program's purpose (and hence content and approach) in terms of the intended audience.[18] In the U.S. these audiences are most often identified by labels such as "women," "Hispanics," "opera lovers," "movie buffs," or "children," that indicate a different underlying attitude toward the reasons people watch television than the attitude inherent in the Sunobe classification scheme, for example. A glance at the schedule of a local public station provides clear evidence of the way in which programs receive "audience labels." What label can be assigned to "Nova"? Certainly the creators and developers of the "Nova" series should not be accused of deliberately producing a program for, say, "science buffs" but such labelling may definitely occur in the way that series is promoted or scheduled (e.g., shown on an evening with other science-related programs), largely as a result of the pervasiveness of the "specialized audiences" model.

Criticism and Change

Criticism of the NHK by Japanese scientists largely centers on its lack of attention to controversial issues. This may be more a symptom of NHK's disinclination to seek out controversy than of its reluctance to present both sides in a particular program or to discuss controversial subjects at all. In the United States, the "Nova" series has received some criticism for over-attention to controversial public issues (notably for the programs "Incident at Brown's Ferry" and "The Plutonium Connection") but it has also been criticized for largely ignoring current controversy or dissensus within science. Most U.S. criticism, however, centers more on the amount and type of science programming or on the lack of formal advisory ties to the scientific community. At present, "Nova" is the primary, nationally-known PBS contribution, although many individual stations do carry syndicated wildlife series or National Geographic "specials" (which are often more travel/adventure programs than presentations of science).

Recognition of the enormous socio/cultural effects and potential of television has been slow in coming from the U.S. scientific community. "The combination of disdain and social grief with which the American intellectual has traditionally approached the American communications media," Anthony Smith argues, "has helped to divert attention from the industry itself. The television institutions and their vast financial and political penumbra have been in the main left free of critical analysis."[19] When criticism does occur, it is almost invariably after the program has been aired or the series scheduled. Improved understanding by scientists and engineers of the techniques, organization, constraints, economics, and motives of the communications industry could increase the possibility that criticism might be made at a more appropriate stage, a point that Jeffrey Kirsch and other public television representatives have stressed.

The United States is in a quite different position from those countries in which the institutional organization of the mass media is the "direct product of social decision-making,"[20] but that makes all the more vital some critical examination of what U.S. public television should be. Scientists concerned about the quality and quantity of science programming, then, must be encouraged to re-examine closely traditional definitions of the public audiences for science, to study what the product is and should be, and to re-assess the goals of public communication of science. Such discussion will be useless, however, unless there are direct routes by which the scientists' concerns (and advice) may be effectively communicated to representatives of public television and--it is hoped--then applied in program development and production. Without that communication, the scientist who advocates improved presentation of science on public television will be relegated to the role of critic of the finished products rather than of advisor on how those products may be made better.

NOTES

1. The U.S.-Japan Joint Survey Seminar on Science and Society was held in Honolulu, HI, 30 January - 2 February 1979, and was co-sponsored by the Japan Society for the Promotion of Science and the National Science Foundation.

2. "A profusion of antennae does not make television 'free' like the press, nor does it make it a 'mirror of society.' The control system arises from society itself, and may be popular or patrician, democratic or authoritarian, depending on how it is organized." From Anthony Smith's incisive essay, "'Just a Pleasant Way to Spend an Evening' - The Softening Embrace of American Television," _Daedalus_ (Winter 1978): 203.

3. Anne W. Branscomb. "A Crisis of Identity: Reflections on the Future of Public Broadcasting," in _The Future of Public Broadcasting_ (New York: Praeger Publishers, 1976), p. 34.

4. _Ibid_.

5. Douglass Cater, "The Haphazard Business of Institution Building," in _The Future of Public Broadcasting_, _op_. _cit_. (Note 3), p. 3.

6. Smith, _op_. _cit_. (Note 2), p. 207.

7. Natan Katzman with Ken Wirt, "Program Funding in Public Television and the SPC," in _The Future of Public Broadcasting_, _op_. _cit_. (Note 3), p. 251.

8. See recent news reports on this subject; for example, Les Brown, "Files Show the Nixon White House Tried to Mold Public TV Politically," _The New York Times_ (24 February 1979): 1, 9.

9. Report of the Carnegie Commission on the Future of Public Broadcasting (1979); quoted in _The Boston Globe_ (15 February 1979): 55.

10. Erik Barnouw, _The Sponsor: Notes on a Modern Potentate_ (New York: Oxford University Press, 1978), p. 181.

11. Constance Holden, "Science Show for Children Being Developed for TV," 202 _Science_ (17 November 1978): 730-731.

12. Top-ranked situation comedies on U.S. commercial networks may achieve 25% to 32% of the audience nationwide. NFL Monday Night Football regularly achieves over 20%.

13. One critic of public television recently characterized these advisory groups as providing "hit-and-run consultation" that has the effect of keeping the scientific community "at arm's length."

14. Smith, *op. cit.* (Note 2), p. 196.

15. Yoshio Sunobe has been working in the planning and production of television science shows for twenty years. He holds a Ph.D. in plant physiology, and many of his staff members are trained as scientists.

16. Yoshio Sunobe, "What Do TV Viewers Expect of Science Programs," paper presented at the U.S.-Japan Survey Seminar on Science and Society, Honolulu, HI, 1 February 1979.

17. Steve Millard, "Specialized Audiences: A Scaled-Down Dream" in *The Future of Public Broadcasting*, *op. cit.*(Note 3), p. 188. Also see the essay by Lloyd N. Morrisett, "Rx for Public Television," in the same volume.

18. Millard, *op. cit.* (Note 18), p. 187.

19. Smith, *op. cit.* (Note 2), p. 197.

20. *Ibid.*

General Bibliography

Bibliography format for periodical articles -- Author. "Article Title." Volume number Periodical Title Issue number (Date): Pages.

Abramson, Mark A. The Funding of Social Knowledge Production and Application: A Survey of Federal Agencies (Study Project on Social Research and Development, Volume 2). Washington, DC: National Academy of Sciences, 1978.

A 504-page report issued by a study project of the NRC Assembly of Behavioral and Social Sciences. ($17.50; ISBN 0-309-02780-2; Office of Publications, National Academy of Sciences, 2101 Constitution Ave., N.W., Washington, DC 20418).

Anderson, Scarvia B., and Samuel Ball. The Profession and Practice of Program Evaluation. London: Jossey-Bass Ltd., 1978.

A guide to the emerging issues and ethical questions in this new field, using analysis of its methods, communication, internal and external pressures, and training of evaluators. The authors propose a "Code of Ethics in Program Evaluation," and offer recommendations for assessing and developing training programs.

Baker, Victor R. "The Spokane Flood Controversy and the Martian Outflow Channels." 202 Science (22 December 1978): 1249-1256.

Does the history of science repeat itself? In this fascinating paper, the author points to strong similarities between the contemporary debate over the origin of channels on Mars (revealed by the Mariner 9 and Viking missions) and the debate earlier in this century over the origin of a region of the Columbia Plateau in eastern Washington known as the Channeled Scabland. Efforts to resolve both problems involve many of the same scientific arguments.

The earlier episode involves J. Harlen Bretz, who, beginning in the 1920's, presented the hypothesis that the Channeled Scabland was the product of a cataclysmic flood. Despite the substantial evidence that Bretz provided, the hypothesis was regarded as "outrageous" and faced vehement opposition until it was eventually verified in the 1950's and 60's. The episode is an illuminating case study of the reception of a controversial explanation.

Bareikis, Robert P., ed. Science and the Public Interest: Recombinant DNA Research. Bloomington, IN: The Poynter Center, 1978.

Proceedings of a conference held in November 1977 to encourage public discussion of the social and ethical issues surrounding rDNA research. Authors of the 15 essays include philosophers, historians, lawyers, a journalist, a legislative aide, an environmental activist, and several

scientists. The perspectives are diverse. The 251-page book is available upon request (postage and handling fee only) from The Poynter Center, 410 North Park Avenue, Bloomington, IN 47405.

Barnes, Barry, and Steven Shapin, eds. Natural Order: Historical Studies of Scientific Culture. London, England: Sage Publications Ltd., 1979.

This collection of essays examines science within the context of parallel cultural events or attitudes. Sections on "The Rise of Naturalism" (theories of the earth, Social Darwinism, the reception of Non-Euclidean Geometry, and "Physics and Psychics" in late Victorian England) and "The Social Basis of Scientific Controversy" (the Biometry-Mendelism controversy, and the heredity vs. environment debate) highlight the volume.

Baum, Robert J., and Albert Flores, eds. Ethical Problems in Engineering. Troy, NY: Center for the Study of the Human Dimensions of Science and Technology, 1978.

Teaching ethics to engineers necessarily requires a variety of reading resources: abstract case studies, applicable codes or regulations, histories of ethical conflicts, and discussions of the philosophical, social and cultural context of engineering ethics. The editors of this 335-page volume have assembled a formidable selection of over sixty pertinent readings of all types, including more than 35 brief case histories. Codes of Ethics or Conduct Guidelines for all important engineering associations are reproduced, accompanied by discussions of the motives for and debate surrounding their implementation and application.

Available for $7.50 from The Center for the Study of the Human Dimensions of Science and Technology, Rensselaer Polytechnic Institute, Troy, NY 12181.

Becker, George. The Mad Genius Controversy: A Study in the Sociology of Deviance. London, England: Sage Publications Ltd., 1978.

During the 19th century, genius began to be redefined as "madness." This exploration of the social, historical and intellectual conditions that led to the redefinition attempts to evaluate "the common use of the labelling paradigm in sociology."

Benne, Kenneth D., and Max Birnbaum. Teaching and Learning About Science and Social Policy. Boulder, CO: ERIC Clearinghouse for Social Studies/Social Science Education, and Social Science Education Consortium, Inc., 1978.

This 131-page monograph is designed as a practical resource for teaching about science-related social issues at the high school and intermediate school levels. Considerable attention is devoted to pedagogic issues. After a general overview, directed to those unfamiliar with the STS literature, several specific curriculum "units" are described: "The Past, Present, and Future of Nuclear Energy"; "Electronic Technology and the 'Information Revolution'"; "Altering the Biological Heredity of Human Beings and Other Life Forms." Sections on scientific background, "suggested learning activities," and additional readings are included for each of the units. [$5.95; SSEC Publication No. 233; available from: Social Science

Education Consortium, Inc., 855 Broadway, Boulder, CO 80302.]

Box, Joan Fisher. R.A. Fisher. The Life of a Scientist. New York: Wiley, 1978.

A biography of a major contributor to the fields of statistics and genetics in the first half of the 20th century. [See A.P. Dempster's review in 203 Science (9 February 1979): 537.]

Butler, C.C. "Some Aspects of Science Education in Britain: A Comparative Study." (new series) 1 Endeavor 3/4 (1977): 129-136.

Broad view of science education in Britain from the middle school level to the preparation of Ph.D.'s. Some comparison is made to other European systems.

Buzzati-Traverso, Adriano. The Scientific Enterprise, Today and Tomorrow. Paris: United Nations Education, Scientific, and Cultural Organization, 1977.

Most reviews of current scientific knowledge consider the cultural or ethical impacts of science on the organization of scientific work in a few final chapters or in a brief introduction, if at all. Although the major portion of this large-format, 440-page book is devoted to well-illustrated, fairly technical descriptions of current theories or information, UNESCO has placed that knowledge in its proper context. The first 5 chapters, therefore, are devoted to the impetus for scientific discovery, the triumphs of science ("Useful Science"), the responsibilities of the scientist ("Dangerous Science"), and the limits of science. Then, in six chapters at the end, the sociological and bureaucratic structure of science, national policies and international politics, and current trends in organization are considered. Finally, in three concluding chapters, the author traces the changes in the human implications of scientific advance--how have our ideas of progress changed? what types of forecasts are being made?--and reviews current approaches to scientific ethics and values. [In U.S., $53.00, available from Unipub, 345 Park Ave. South, New York, NY 10010; also published in Spanish and Italian editions; write UNESCO, 7 Place de Fontenoy, 75700 Paris, France for ordering information.]

Calder, Nigel. Spaceships of the Mind. New York: Viking Press, 1978.

Nigel Calder believes that the world is shaped by "the imagination and ambition of individuals who have big ideas." Since his primary occupation is that of a communicator of science, it is not surprising that most of the persons included here are scientists or engineers. The book is intended as a companion volume to a BBC television program that included interviews with these scientists and described their projects, and therefore is written as a popular book for non-scientists, not as a scholarly text. The selection of projects and the way in which these persons regard their often extravagant ideas does, however, say something about the spirit of adventure and optimism that lurks within big technological projects. The scientists, J.D. Bernal, Freeman Dyson, Gerard O'Neill, James Lovelock, Lynn Margolis (to name only a few of those discussed in the first chapters) are a scientifically-diverse lot; they are not necessarily recognized by the public; and yet the book presents their work in a way that should be understood by most non-scientists without distorting importance of the ideas or giving the scientists a false "celebrity" status.

Cannon, Susan Faye. Science in Culture: The Early Victorian Period. New York: Science History Publications (Neale Watson), and Folkstone, Kent, England: Dawson, 1978.

A "bold, iconoclastic survey" of science in early Victorian Britain. [See Arnold Thackray's review in 203 Science (5 January, 1979): 41-42.]

Carter, Luther J. "Public Support for Environmental Protection Remains Strong." 203 Science (12 January 1979): 154.

Recent opinion polls show broad public support for environmental regulation, despite awareness of the costs that regulation entails.

"China in Transition." 203 Science (9 February 1979): 505-515.

This issue features several articles describing a 3-week visit to the People's Republic of China by the AAAS Board of Directors: "Education, Science, and Technology in China," by Philip Abelson; "The Chinese Scene," by William D. Carey; and "China: Objectives, Contradictions, and Social Currents," by E.E. David, Jr. The aims of the visit and cooperative arrangements between the AAAS and the Chinese Scientific and Technical Association are outlined in William Carey's report on pp. 533-535.

Cole, Stephen, Leonard Rubin, and Jonathan R. Cole. Peer Review in the National Science Foundation, Phase One of a Study. Washington, DC: National Academy of Sciences, 1978.

The process by which research proposals are evaluated periodically attracts criticism from both Congress and the research community. Is the peer review system fair? Does the system successfully identify the "best" programs? Are significant developments being missed? Because of these concerns, the NAS Committee on Science and Public Policy sponsored an extensive study of peer review, choosing the NSF as target of the investigation and a group of sociologists as the investigators. The results of Phase One are clearly presented in this 208-page review. Briefly, the project found that peer review does play an important role in the funding decisions, that there was no real evidence of institutional favoritism by reviewers, and that there was no high correlation between grants awarded and previous scientific achievement or age of the applicant. [$10.75; ISBN 0-309-02788-8; order from Office of Publications, NAS, 2101 Constitution Avenue, N.W., Washington, DC 20418.]

Colton, Kent W. "The Impact and Use of Computer Technology by the Police." 22 Communications of the ACM 1 (January 1979): 10-20.

Although the growth has been slower than predicted, the use of computer technology in U.S. police departments is increasing, particularly in "nonroutine" uses such as resource allocation or strategic planning. This article describes case studies from an extensive research project and is framed around four central issues: do these applications of computers really work? what are the technical impacts? what have been the impacts on the degree to which the public is served and the quality and quantity of that service? have their been "power shifts" among the various individuals or units? The author points out that many of the early predictions and promises for use have simply not come true, but that the solution lies somewhere in between the anti-technologists and the vendors. The author reminds his readers that: "The greatest strengths of computer technology seem closely related to its greatest weaknesses. Computers have the potential to aid in criminal justice activities through the rapid communication of accurate and complete information, and perhaps a more rational approach to decision-making. We must realize that there are limits to this technology, though, and not overestimate the potential. These very benefits, if not properly controlled or planned, may result in misuses, unintended consequences, wasted resources, and frustrations. [p.19]"

Committee on a Study of Postdoctorals and Doctoral Research Staff in Science and Engineering, Commission on Human Resources, National Research Council. Nonfaculty Doctoral Research Staff in Science and Engineering in United States Universities. Washington, DC: National Research Council, 1978.

This report on the first national study of doctoral research staff in U.S. universities states that increasing numbers of doctoral scientists and engineers are taking research positions that are neither postdoctoral nor faculty appointments. The committee links this change to shrinking college enrollments and reductions in faculty hiring. Limited copies of the 128-page report are available from the Commission on Human Resources, 2101 Constitution Avenue, N.W., Washington, DC 20418.

Coughlin, Ellen K. "Educators, Scientists Fear New Federal Ethics Code." The Chronicle of Higher Education (20 February 1979): 1,15.

This article reviews the provisions of the Ethics in Government Act of 1978, which becomes effective on 1 July 1979, and indicates why there is growing concern that the law's restrictions will discourage scientists and other scholars from working for federal agencies. Designed to cure conflict of interest by high-ranking government officials after they leave their government jobs, the Act places stringent restrictions on the contacts a former executive-branch officer may have with the federal government. See also: "Stiffened Federal Ethics Law May Make Officials Quit," by Joanne Omang. The Washington Post (31 January 1979): A3.

Davis, Karen, and Cathy Schoen. Health and the War on Poverty: A Ten-Year Appraisal. Washington, DC: The Brookings Institution, 1978.

An assessment of four major government public health programs (Medicaid, Medicare, Neighborhood Health Centers, and the Maternity and Child Health Program) finds that, although some improvements in availability to the poor and funds for catastrophic family expenses have been made, by and large the benefits are unevenly distributed, do not reach all the intended recipients, are often inefficiently administered, and fail to achieve all that was expected of them. [Available from Brookings, 1775 Massachusetts

Avenue, N.W., Washington, DC 20036; $11.95, cloth; $4.95, paper.]

Divine, Robert A. Blowing on the Wind: The Nuclear Test Ban Debate, 1954-1960. New York: Oxford University Press, 1978.

History of the events and the motivations for seeking a nuclear test ban agreement, including analysis of the arguments advanced for and against the ban.

Dukas, Helen, and Banesh Hoffmann, eds. Albert Einstein: The Human Side. New Glimpses from His Archives. Princeton, NJ: Princeton University Press, 1979.

Bits and snatches of correspondence, conversations, diary entries, and verse from the man for whom "every peep becomes a trumpet solo" [Einstein to Ehrenfest, 21 March 1930]. Each item is introduced or explained in clear, succinct prose by the compilers (Einstein's literary trustee and archivist, and a well-known colleague of Einstein, respectively). Sections focus, in a quite general way, on such topics as music, Zionism, and the meaning of human life, but ultimately the only topic of the book is Einstein's personality and his gentle hold on life.

Edwards, George C., III, and Ira Sharkansky. The Policy Predicament: Making and Implementing Public Policy. San Francisco, CA: W.H. Freeman and Co., 1978.

Although this book does not especially concentrate on scientific or technical policy issues, its relevance to those issues is clear. The influence of public opinion, the economic and political constraints, and the process of equitable decision-making can cause serious problems in the smooth development and implementation of science policy. The authors are describing what they feel is the "general inability of policy-makers to respond in a clear and productive manner to the many signs of unmet needs." But they propose no solutions--instead their aim is clear definition of the processes and problems. For example, the chapter on "Economic Constraints on Decisionmaking" contains sections on monetary policy, fiscal and regulatory policies, resources and demands related to economic development, as well as "noneconomic factors that affect the influence of the economy on public policy."

The European Journal of Science Education. Volume 1, No. 1 (January-March 1979).

A new journal from the European scientific community, sponsored by the Institute for Science Education (IPN), Kiel, Federal Republic of Germany. The first issue contains general articles on trends in chemistry education research, concept formation in biology, and the UNESCO-UNEP program in environmental education. Reports of research, teaching innovations, and educational plans are included. [Publisher: Taylor & Francis, Ltd., 10-14 Macklin Street, London WC2B 5NF, England.]

French, A.P., ed. Einstein: A Centenary Volume. Cambridge, MA: Harvard University Press, 1979.

In this well-designed publication by the International Commission on Physics Education, a portrait of the humanity and scientific work of Einstein is presented through reminiscences by colleagues, analyses by historians, and a selection of his critical writings. Many of the reminiscences are taken from previous publications (e.g., those by Maurice Solovine, Philipp Frank, Robert Oppenheimer, Pablo Casals, C.P. Snow), but the major part of the book contains essays written especially for this volume by, among others, Silvio Bergia, I. Bernard Cohen, Martin J. Klein, Gerald Holton, and Boris Kuznetsov. Although the book should appeal to a wide range of readers, the essays were especially planned to be of interest to physics teachers and students in secondary schools and universities. Includes a brief bibliography, numerous illustrations and photographs, and an extensive collection of quotations by or about Einstein (placed in wide margins at appropriate points in the essays).

Gibson, William C., compiler. The Excitement and Fascination of Science: Volume Two, Reflections by Eminent Scientists. Palo Alto, CA: Annual Reviews, Inc., 1978.

Scientists who are asked to write an autobiographical essay often seem suddenly conscious of being "eminent" and their prose is thus tedious, dull, and indiscriminate. Given the space, even normally reticent researchers will go on at length about their childhood pets, youthful escapades, nicknames, and grammar school teachers. Fortunately, most eventually concentrate on their scientific careers and, in these descriptions, readers learn of crucial "turning points" as a topic is chosen or theory rejected, the importance of mentors or advisors, the struggles to achieve support or recognition, and the active networks of colleagues. Although most of the 34 essays in this book are straightforward "reminiscences," several do deserve special mention: Fred Eggan's "Among the Anthropologists," Ragnar Granit's "Discovery and Understanding," David Nachmansohn's "Biochemistry As Part of My Life," E.J. Öpik's "About Dogma in Science and Other Recollections of an Astronomer," and Max Kleiber's wit and bons mots in "An Old Professor of Animal Husbandry Ruminates."

Gillick, Muriel. "The Criteria of Choice in Medical Policy: Radio Therapy in Massachusetts." 15 Minerva (Spring 1977): 15-31.

The decision to purchase new equipment for radio therapy in Massachusetts is used to illustrate some of the problems that arise in medical policy. This highly critical analysis focuses on criteria used and those ignored.

Greenberg, Daniel S., ed. Science and Government Report International Almanac, 1978-1979. Washington, DC: Science and Government Report, 1979.

According to the publisher's announcement, the volume "will consist of original articles on science-policy developments in the industrialized and major developing nations, written by leading science-policy journalists and academic specialists, plus the texts of important science-policy documents issued in the period covered." [Available from: Science and Government Report International Almanac, P.O. Box 6226, Washington, DC 20015. Prepublication price, $54.00; regular price, $75.00.]

Greenberg, Daniel S. "Scientific Magazines Bursting Out All Over." 9 Science and Government Report 1 (15 January 1979): 1-2.

Brief news item on the boom in "selling news of science to the general public"--from Omni to the reported ventures of the AAAS, Time Inc., and CBS-TV.

Harnik, Peter. "The Ethics of Energy Production and Use: Debate Within the National Council of Churches." 35 Bulletin of the Atomic Scientists 2 (February 1979): 5-9.

Commentary on a recent debate culminating two years of study, panel work, and discussions by the National Council of Churches. The author describes the circumstances and conflict at the debate but notes that the 45-page NCC report is "the first major energy statement ever to look at morality and values rather than hardware and economics." [Energy & Ethics: The Social Dimensions; National Council of Churches, 475 Riverside Drive, Room 572, New York, NY 10027.]

Henig, Robin Marantz. "NSF Public Television Project Brings Science Policy to the People." 29 Bioscience 2 (February 1979): 125-126.

A news report on the KPBS-TV (San Diego) "Synthesis" series on science policy. [See the article by Jeffrey Kirsch, "Synthesis" producer, in this issue of STHV.] The news report quotes Dr. Kirsch as attributing much of the series' success to the scientific advisory panel which suggests and helps to choose topics for programs.

Hirsch, Helmut, and Helga Nowotny. "Information and Opposition in Austrian Nuclear Energy Policy." 15 Minerva (Autumn-Winter 1977): 316-334.

In an effort to further the production of nuclear power without arousing violent protest, the Austrian government initiated an "information campaign" that included in addition to other aspects, a series of public debates. This article assesses the conduct and impact of the campaign on the public and the government.

Inhaber, Herbert. "Risk With Energy From Conventional and Nonconventional Sources." 203 Science (23 February 1979): 718-723.

This article reports the results of a study comparing the risks to human health arising from eleven methods of generating energy. Five were "conventional" sources--coal, oil, natural gas, nuclear, and hydroelectricity; and six were "nonconventional" (i.e., those not now producing large amounts of energy)--solar, photovoltaic, solar space heating, methanol, wind, and ocean thermal. The most important conclusion drawn is that "when the entire fuel or energy cycle, rather than only one part of it, is evaluated, the risks from nonconventional energy systems can be substantially higher than those of some conventional systems."

Irvine, John, Ian Miles, and Jeff Evans, eds. Demystifying Social Statistics. London, England: Pluto Press, 1979.

Twenty-five articles that appraise the development, content, use and abuse of social statistics, including critiques of official statistics, public opinion polls, cost benefit analyses, social forecasting, and increased use of computer analysis. Several articles look at the historical bases for current statistical methods.

Jackson, M.W. "Science and Depoliticization." 28 Impact of Science on Society 4 (October-December 1978): 359-367.

A complex examination of the "technocratic perspective" characteristic to such countries as Australia, Canada, and the U.S. The author discusses the substitutes for political action, inherently optimistic values, emphasis on individualism, and the effort to depoliticize science and technology. The author appears to argue that a scientifically or technocratically based public policy may not be the best or only model for nations who are concentrating on integrated transfer of science and technology. "Learning the lessons that are to be found in the characteristics and implications of science as a tool of public policy in industrial nations is necessary if mistakes are to be avoided elsewhere."

Kevles, Daniel J. "Robert A. Millikan." 240 Scientific American 1 (January 1979): 142-151.

Historical review of the public and private science of physicist Robert Millikan.

Kolata, Gina Bari. "Anti-Semitism Alleged in Soviet Mathematics." 202 Science (15 December 1978): 1167-1170.

Discrimination against Jews in the Soviet Union is neither new nor restricted to practitioners of particular professions. However, the situation in the Russian mathematics community appears to be worse than in other scientific disciplines. This article describes recent instances of repression and analyzes their effects, both within and outside of the Soviet Union. A companion article, "A Program to Aid Soviet Jewish Mathematicians," sets forth the key features of a plan devised by Russian mathematicians to help end the discrimination.

Levine, Carol. "Ethics and Health Cost Containment." The Hastings Center Report (February 1979): 10-13.

Report of a Fall 1978 conference on "Ethics and Health Cost Containment" that focused on three critical policy issues: what should the health care delivery system deliver? how can services be allocated justly? who should make the decisions? The article provides an overview of the "profoundly divergent views on the future goals of American health care [that] were expressed by the sixty participants. . ."

Lindsey, Duncan. The Scientific Publication System in Social Science. London: Jossey-Bass Ltd., 1978.

Was it inevitable that the sociologists would sooner or later begin to study their own communications system? The book's subtitle is "A Study of the Operation of Leading Professional Journals in Psychology, Sociology, and Social Work," and it may have two primary audiences: those who want to publish (in that case, it may act as a primer) and those who want to study those who publish.

Lipsett, Mortimer B., John C. Fletcher, and Marian Secundy. "Research Review at NIH." The Hastings Center Report (February 1979): 18-21.

This article focuses on the role of non-scientist, non-government members of the research review groups at NIH's Clinical Center. The authors begin by tracing the evolution of the center's review mechanism, from the initial clinical research committees composed only of scientists, to the present Institute Research Subpanels which are required to have non-physician and non-government members. They then turn to an analysis of the difficulties faced by these "outsider" members of the review groups.

Lovekin, David, and Donald P. Verene, eds. Essays In Humanity and Technology. Dixon, IL: Sauk Valley College, 1978.

Six papers, from a conference held at Sauk Valley College in Spring 1977, by Edward Ballard, Lionel Rubinoff, Donald Verene, Langdon Winner, Henry Johnstone, and David Lovekin. In his review of the volume, Steven L. Goldman praised the essays as "provocative" and noted especially their value as introductory readings for a college course. [$3.00; for more information, write the editors at Sauk Valley College, Dixon, IL 61021.]

Marshall, Eliot. "Environmental Groups Lose Friends in Effort to Control DNA Research." 202 Science (22 December 1978): 1265-1269.

This article contends that disagreements about recombinant DNA research guidelines have led several prominent scientists to break with environmental groups which they had formerly supported. Faced with criticism and an absence of technical support, at least one group, the Natural Resources Defense Council, is reassessing its decision to campaign for tighter guidelines. However, neither the Environmental Defense Fund, nor the most active advocate of control, Friends of the Earth, plan to curtail their efforts toward regulation. The article suggests that environmental groups have a "vested interest" in the outcome of the regulation issue, and questions whether they can legitimately claim to speak for the "public interest." For responses to the article, one highly critical, the other expressing agreement, see the "Letters" section, 203 Science (26 January 1979): 314-316.

Marshall, Eliot. "Universities 'Battered' by Federal Regulators." 202 Science (1 December 1978): 955-956.

In a speech this fall Jerome B. Wiesner, president of M.I.T. and former science advisor to Presidents Kennedy and Johnson, charged that the relationship between government and the big research universities is "floundering" because the government has dropped its "attitude of understanding, encouragement, and support" and is instead viewing the universities as "purveyors of products, to be held accountable by the standards of trade and commerce."

Mazmanian, Daniel A., and Jeanne Nienaber. Can Organizations Change? Environmental Protection, Citizen Participation, and the Corps of Engineers. Washington, DC: The Brookings Institution, April 1979.

Environmentalists and advocates of increased public involvement in bureaucratic decision-making have frequently criticized the U.S. Army Corps of Engineers as an "entrenched bureaucracy" that was, in general, unaware of the environmental consequences of its activities. The authors focus on five recent Corps projects and trace the agency's response to external demands for change and the form of public participation programs that resulted. [Available from Brookings, 1775 Massachusetts Avenue, N.W., Washington, DC 20036; $11.95,cloth; $4.95, paper.]

Mendelsohn, Everett, Dorothy Nelkin, and Peter Weingart, eds. The Social Assessment of Science: Proceedings. Bielefeld, West Germany: Forschungsschwerpunkt Wissenschaftsforschung, 1978.

In May 1978, the Center of Interdisciplinary Research and the Science Studies Unit of the University of Bielefeld co-sponsored a conference on social assessment of science with the International Council for Science Policy Studies [for a news report on that meeting, see STHV, No. 25, Fall 1978, pp.6-7]. This volume assembles ten of the papers presented at the conference, one which dealt directly with the assessment of research. As examples some papers focused on recombinant DNA, fetal research, radiation protection standards, and institutional review boards, among other topics. Other articles placed these assessment endeavors in the context of value conflict and the politics of science. Contributors included Jerry Ravetz, Frederick Cramer, Ron Johnston, Bradford Gray, Daniel Serwer, Yaron Ezrahi, and the editors of the proceedings. [Write to: Science Studies Unit (Forschungsschwerpunkt Wissenschaftsforschung), Universität Bielefeld, Universitätsstrasse, 4800 Bielefeld 1, West Germany.]

Metz, William D., and Allen L. Hammond. Solar Energy in America. Washington, DC: American Association for the Advancement of Science, 1978.

An excellent technical explanation for non-specialists of the economic, engineering, bureaucratic, social, and policy aspects of the development of solar energy. Chapters on the conventional "power tower," photovoltaic cells, innovations in collector design, biomass energy, wind power, storage, and ocean thermal energy include discussions on both current and future projects and appraisals of the prospects for implementation. [228 pp. + index; $18.50, hardbound, and $8.50, paper; order from AAAS, Dept. ES-9, 1515 Massachusetts Avenue, N.W., Washington, DC 20005.]

Michaelis, A.R. "Albert Einstein as Seen by Artists." 3 Interdisciplinary Science Review 4 (December 1978): 263-264.

When asked his profession by a stranger in a railway carriage, Einstein is said to have replied, "I am an artist's model." Certainly he was a popular subject for painters, sculptors, and cartoonists. This issue of ISR contains several articles on Einstein (many of which are reprinted reminiscences) that have been illustrated with a series of representations of the scientist by a wide variety of artists, professional and amateur. Comparison of these renditions with one of the current collections of photographs would provide an interesting starting-point for analysis of the differences between the public face and the reality.

Mohr, James C. Abortion in America. The Origins and Evolution of National Policy, 1800-1900. New York: Oxford University Press, 1978.

In an enthusiastic review, historian Ronald Numbers describes Mohr's work as a "clearly written, impressively researched account of abortion in 19th-century America. . . .full of historical surprises." [See 202 Science (1 December 1978): 967-968.]

National Research Council, Committee on Minorities in Engineering. Scope and Activities. Washington, DC: National Academy of Sciences, 1978.

This 8-page report on the Committee's mandate and current activities may be obtained, without charge, by writing the Committee on Minorities in Engineering, Assembly of Engineering, National Research Council, 2101 Constitution Ave., N.W., Washington, DC 20418.

Nelkin, Dorothy. "Participation and Expertise in Nuclear Decisions: Some European Experiments." EIA Review (M.I.T.) 2 (October 1978): 42-45.

Brief review of efforts in Sweden, the Netherlands, and Austria to reform conventional modes and channels for public involvement in such technology-based issues as nuclear power. The author uses these efforts at participatory reform to discuss some of the implications of greater public involvement in science or technology-related public decisions.

Nicholson, Heather Johnston, and Ralph L. Nicholson. Distant Hunger: Agriculture, Food and Human Values. West Lafayette, IN: Purdue University, 1978.

Hunger--which transcends all cultures, languages, and value systems--is a world problem that increases in technical, political, economic, social, and moral complexity as traditional forms of agriculture are disregarded and as the "improvements" of technology simply mean more complex systems to manage or use in feeding the hungry. This book, Volume 3 in the Purdue Series in Science, Technology, and Human Values, examines the methods, alternative conceptions of problems, and prospects for change in the world's food supply system. [$3.95; available from Purdue University Office of Publications, South Campus Courts-D, West Lafayette, IN 47907.]

Peterson, Russell W. "Impacts of Technology." 67 American Scientist 1 (January-February 1979): 28-31.

The Director of the Office of Technology Assessment argues that, although "today we have no choice but to go forward," we must do so cautiously and attempt to assess each new scientific and technical accomplishment "in its proper setting, against the backdrop of the entire national and global society in which it operates."

Privacy, Security, and the Information Processing Industry; a Report of the Ombudsman Committee on Privacy, Los Angeles Chapter of ACM (Dahl A. Gerberick, Chairman). New York: Association for Computing Machinery, 1978.

This 200-page report sets forth guidelines for implementing the privacy/security recommendations in currently published studies, including administrative, technological, and legal considerations. [$12.00; ACM Order Dept., P.O. Box 12105, Church Street Station, New York, NY 10249.]

Radnor, Michael, Irwin Feller, and Everett Rogers, eds. The Diffusion of Innovations: An Assessment. Evanston, IL: Center for the Interdisciplinary Study of Science and Technology, Northwestern University, 1978.

Research on the diffusion of innovations traces its roots to 1930's studies of the diffusion of hybrid corn in Iowa. Since that time, the methodology has been frequently and widely applied, but, as the editors point out, it has had "only modest impact at best on management practice and policy-making." The goal of a November 1977 Workshop was to re-assess diffusion research--are existing forms of professional communication too limited to encourage resolution of many of the key issues? What is the extent of conceptual similarities and differences in innovation research in the various disciplines? Can this research be made more useful to those who must design or oversee technology transfer and utilization programs?

Restivo, Sal, and Michael Zenzen. "A Humanistic Perspective on Science and Society." 2 Humanity and Society 4 (November 1978): 211-236.

The humanistic perspective on science and society outlined by the authors in this paper suggests to them the need for a "new perspective on and transformation of the sociology of science." They identify and discuss several regions of their holistic paradigm--subject of inquiry, theory of action, frameworks of knowledge and comprehension, nature of reality, theory of inquiry and comprehension, consciousness and communication, and, finally, pose sets of basic queries for their argument that science can be compatible with humanistic values.

Ribes, Bruno. Biology and Ethics. Paris, United Nations Educational, Scientific, and Cultural Organization, 1978.

The author describes this book as a "reflection" on the discussions on biology and ethics that took place at a UNESCO-sponsored conference in June 1975. That meeting marked a new stage "in this history of UNESCO's contribution towards clarifying" the ethical problems raised by the new biology. Rather than presenting the papers and discussions in an "organized, traditional" form, Ribes attempts to synthesize the material, aiming to "help define the concept of a new functional ethic and encourage research in ethics." UNESCO's goal in this project is "an investigation bearing both on measures to guarantee that research will be continued in the best possible safety conditions, and on the content of a research policy which would free mankind from the fear of the bacteriological armamentarium. . . .the project gives its full significance to an exacting philosophical reflection on what should be the role of knowledge and its relation to action, on how to develop a world in which man can live better. . ., and in the malaise which our age must overcome." [$12.75, paper; in U.S., available from Unipub, 345 Park Avenue South, New York, NY 10010; elsewhere, write UNESCO, 7 Place de Fontenoy, 75700 Paris, France, for name of distributor.]

Robertson, John A. "Ten Ways to Improve IRBs." The Hastings Center Report (February 1979): 29-32.

In the author's view, there are "structural" and "administrative" problems with the current system of IRB review. He suggests reforms which he believes can improve the process "without unreasonably damaging research," although he acknowledges that "nearly all of these measures entail costs."

Russell, Colin A., with Noel G. Coley and Gerrilyn K. Roberts. Chemists by Profession. Milton Keynes, England: Open University Press, 1977. (Distributed in the U.S. by Humanities Press, Atlantic Highlands, NJ.)

In this history commissioned to celebrate the centenary of the Royal Institute of Chemistry, the authors seek not only to chronicle the Institute's development, but also to trace the evolution of chemistry as a profession in Britain. [See the review by John W. Servos in 203 Science (5 January 1979): 42-43.]

Ryan, Kenneth J. "Ethics and Pragmatism in Scientific Affairs." 29 Bioscience 1 (January 1979): 35-37.

This commentary argues for better understanding by scientists of considerations of public safety, ethics, and obligations. "It is a worthy challenge to science to learn to function effectively within the climate of great public participation and interest. . . .If the scientific community has fared less well than hoped, it must share part of the blame for ineptitude in the political process and insensitivity to the extent of public concern" (p. 37).

Schlegel, Richard. "Progress and Completeness in Science." 22 The Centennial Review (1978): 375-388.

Scientific progress will continue in the future for three reasons, according to Schlegel: nature is so complex that its study cannot be exhausted; the general principles yielded by science to describe natural phenomena generate more scientific investigation; and scientific study has widespread social and political support because of benefits that come from the technological applications of science. However, there are limits to scientific progress inherent in nature. The study of atomic particles has demonstrated that the reaction of a specific particle can only be determined by observing the particle; its behavior cannot be predicted except with a model of statistical probability. As "rigorous determinism" is not the case in physics, neither is it the case in social sciences. Human beings, although their behavior may be predicted with a certain statistical probability under given circumstances, react uniquely. Thus, while science is a key element in understanding ourselves and our world, it is not the complete or final answer to human progress.

Self, Donnie J., ed. The Role of the Humanities in Medical Education. Norfolk, VA: Bio-Medical Ethics Program, Eastern Virginia Medical School, 1978.

These proceedings of an April 1977 Symposium contain six essays by humanists who relate their disciplines to medical education and suggest areas for improved interaction. Papers include "Philosophy and Medical Education," "The Wonders of Literature in Medical Education," and "Liberating Medical Minds: Can Historians Help?" [Available from Bio-Medical Ethics Program, P.O. Box 1980, Norfolk, VA 23501; $5.00.]

Singer, Maxine F. "Spectacular Science and Ponderous Process" (editorial). 203 Science (5 January 1979): 9.

One of the first scientists to call for caution with recombinant DNA research charges that HEW's regulatory procedures are "unsuitable to the complex problem of controlling creative activities. . .Neither scientific criteria nor the public interest has been well served by HEW's actions."

Smith, David H., and Linda M. Bernstein, eds. No Rush to Judgment: Essays on Medical Ethics. Bloomington, IN: The Poynter Center, 1978.

Sixteen cogent essays from various conferences sponsored by The Poynter Center in 1977 and 1978 explore the ramifications of medical progress for human choice, values, and quality of life. Three major issues predominate: the professional ethics of medicine, when does life begin or end and who decides, and how can resources be allocated in a just manner. Authors include James F. Childress, William F. May, Robert M. Veatch, Roy Branson, and Norman Fast. The 361-page volume is available, upon request, from: The Poynter Center, 410 North Park Avenue, Bloomington, IN 47405.

Smith, R. Jeffrey. "Toxic Substances: EPA and OSHA Are Reluctant Regulators." 203 Science (5 January 1979): 28-32.

Agency officials quoted in this article appear to agree with the author that "prompt regulatory action is virtually nonexistent, and when action does occur, it is usually at the prodding of outside citizen groups." Not unexpectedly, however, there are different explanations of why "the regulatory road from discovery of a hazard to its control remains rough."

Special Issue on Sociobiology. 13 Berkshire Review 2 (1978).

These edited papers from a two-day colloquium of Amherst, Wesleyan, and Williams faculty members range across the varied issues raised by sociobiology for the natural sciences (e.g., human evolution, sex differences), the social sciences (e.g., knowledge and freedom), and the humanities (e.g., impact on political thought and social theory). As a way of preserving the interplay of ideas essential to such an unresolved issue as sociobiology, the Review chose to follow each pair of papers with the formal remarks by commentators and the rejoinders of the speakers. Thus, we are given not only the various academic perspectives on sociobiology, but can also glimpse some of the common misperceptions, biases, and disciplinary antagonisms that have peppered debate on this subject. Major papers were presented by W.F. Zimmerman, A. Johnson, M.S. McPherson, J.S. Meister, P. Pomper, and N. Lawrence. [Berkshire Review, Williams College, P.O. Box 633, Williamstown, MA 01267.]

Stolz, Stephanie B., and Associates. Ethical Issues in Behavior Modification; Report of the American Psychological Association Commission. London: Jossey-Bass Ltd., 1978.

The APA Commission on Behavior was given the task of examining and clarifying the ethical issues in this area and of developing recommendations regarding its use and misuse. The report defines the major problem areas (confidentiality, informed consent, accountability, method selection, and the allegiances of psychologists) and discusses them in relation to such settings as community mental health centers or institutions for the retarded.

Swan, Jon. "Uncovering Love Canal." 17 Columbia Journalism Review 5 (January/February 1979): 46-51.

Interesting analysis of the work by a small newspaper that uncovered the story of a major environmental pollution disaster.

Veatch, Robert M. "The National Commission on IRBs: An Evolutionary Approach." The Hastings Center Report (February 1979): 22-28.

In September 1978, the National Commission for the Protection of Human Subjects issued its report and recommendations on Institutional Review Boards (IRBs). This article assesses the changes that the commissions' recommendations would make in existing Department of Health, Education, and Welfare regulations: "[s]ome changes seem to be clear improvements, others are more debatable; some are major and controversial policy shifts, others mere tinkering." Veatch is especially critical of the failure of the report to "address the basic issues of the roles of lay people and professionals more explicitly."

Walsh, John. "Harvard, Science, and the Company of Educated Men and Women." 202 Science (8 December 1978): 1063-1066.

The avowed purpose of Harvard's undergraduate curriculum is to prepare students to join "the company of educated men and women." How much training in science and mathematics should be required in a program with that aim? Debates about Harvard's proposed new "core curriculum" reveal that opinion is sharply divided, not surprisingly, along disciplinary lines. According to this article, "a significant segment" of faculty in the natural sciences "feel that the core curriculum requirements do a disservice by implying that the minimal science and mathematics standards set are adequate in a technological age."

Walsh, John, et al. "It Could Have Been Worse for R&D in Carter's 'Austerity' Budget." 203 Science (2 February 1979): 416-419.

An analysis of R&D in President Carter's FY1980 budget, by area: health, science, energy, agriculture, space, defense, and environment. In general, basic research fared well, and is one of the very few program areas to be slated for more than a cost-of-living increase. A conspicuous exception is fundamental research in the biomedical sciences: the proposed budget would cut by nearly one-half the NIH funds for new, investigator-initiated grants, and would also sharply reduce funds to support the education of physicians and other health professionals.

Weart, Spencer R., and Gertrud Weiss Szilard, eds. Leo Szilard: His Version of the Facts, Selected Recollections and Correspondence. Cambridge, MA: The M.I.T. Press, 1978.

Documents and letters of Leo Szilard from the period 1930-45 form the core of this collection, but the compilers have gone beyond the ordinary task of assembling papers. Each section is introduced by a selection from tape-recorded "recollections"; the editors have also written explanatory notes to link the documents and included many letters from the other principal actors in the events described. The quote that heads Chapter I ("You don't have to be much cleverer, you just have to be one day earlier") typifies the gentle admiration the compilers feel for their subject. The reader is quickly drawn into this spirit. Letters to Polanyi, Rutherford, and Lindemann show Szilard working to place refugee scientists in the late 1930's. The letters to Joliot, Wigner, Einstein, Sachs, and Roosevelt clarify some of the decisions made in the early 1940's, and the postwar letters, petitions, and statements outline the ethical dilemmas Szilard and others were willing to confront. The volume supplements publication of Szilard's scientific papers.

Wildavsky, Aaron. "No Risk Is the Highest Risk of All." 67 American Scientist 1 (January-February 1979): 32-37.

What we plan for the future, Wildavsky argues, determines our present in far more radical ways than we may have anticipated. Wildavsky hears the alarm bell ringing with increasing frequency and asks if Chicken Little is "alive and well in America." Is there something new in our environment or in our social relations that has caused this alarm? Why have we acted to socialize risk even while we are unhappy with the mechanisms we have devised for collective response? Wildavsky targets the political aspects of risk arguments and points out that each action to reduce risk has its own effect, often stimulating a new risk (e.g., catalytic converters on automobiles; use of certain drugs). How is risk distributed and is it equitable when citizens "may not choose what dangers they will face" as risk is collectivized? A provocative and intriguing article.

Wohlwill, Joachim F. "A Psychologist Looks at Land Use." 3 Environmental Review 1 (Fall 1978): 34-48.

"Land use, and the related issues of ownership and stewardship, have long been at the forefront of social, as well as ethical concerns," but what is the relationship of psychology to these questions? The author argues that the diversity of individual use, the impact of land use on the senses, and the deep-seated feelings, attitudes, and values that may be associated with the land provide significant aspects for study by psychologists.

"Women, Science, and Society." Special Issue. 4 Signs 1 (Autumn 1978).

This is a very full issue, highlighted by contributions on the history and sociology of women in scientific careers. Lois Wagner, in "Women and the Scientific Idiom: Textual Episodes from Wollstonecraft, Fuller, Gilman, and Firestone," examines these noted feminists' uses of scientific ideas and theories in their battles for equality. Sally Gregory Kohlstedt, in "In from the Periphery: American Women in Science, 1830-1880," divides these women into three generation groups: the first were characterized by "individual, unselfconscious, and largely unrecognized efforts," the second worked primarily as educators and popularizers of science, and the third "were forced to choose between amateur, local club activity, and a more rigorous career within the emerging professional modes of post-Civil War America." Michele L. Aldrich provides an excellent review of current literature and resources on the subject of women in science (statistics, history, education, and major conferences). A similar review for women in medicine was compiled by Dorothy Rosenthal Mandelbaum. In two brief reports, Margaret W. Rossiter extends previous discussion of occupational segregation to the situation in the sciences ("Sexual Segregation in the Sciences: Some Data and a Model") and Anne M. Briscoe looks at the 1970's phenomenon of women's caucuses in the scientific and technical societies.

Ziman, John. Reliable Knowledge: An Exploration of the Ground for Belief in Science. New York: Cambridge University Press, 1979.

Adopting "the intellectual strategy of a typical paper in theoretical physics," John Ziman sets out to ask "how much ought we to believe of what science might tell us about man as a conscious social being, subject to unreasonable emotions and irrational institutions?" He, of course, does not pretend to answer that question and, in some sense, addresses more the nature of the basis for scientific knowledge, the intentions and motives of scientific assumptions, and the public image of scientific knowledge. In his discussions of unambiguous communication in science and of the metaphors of science he, in fact, helps us to understand why the public may be willing to accept scientific knowledge as reliable without any serious question of its correctness. Ziman's focus is the attempts by the behavioral sciences to produce a "science of society"--"Do we have such a science? If so, how much of it is to be believed?"--and he ultimately dismisses the major conceptual schemes of that field as impotent, concluding that "the challenge to the behavioral sciences does not come from physics. . .but from the humanities."

Meetings Calendar

8-10 May 1979	The World Future Studies Conference, Berlin, West Germany. Topic: "Science and Technology for the Future." Contact: Hans Buchholz, Giesebrechtstr. 15, D-1000 Berlin 12, West Germany.
18-20 May 1979	Philosophy and Economics Conference, Michigan State University, East Lansing, MI 48824. Contact: Bruce Miller or Richard Peterson, Department of Philosophy, Michigan State University, East Lansing, MI 48824.
3-5 June 1979	Seventh Annual Meeting of the Society for Exact Philosophy, Montreal, Canada. Conference organizer: Mario Bunge, Foundations and Philosophy of Science Unit, McGill University, 3479 Peel Street, Montreal H3A 1W7, Canada.
4-8 June 1979	Second IFIP Conference on Human Choice and Computers, Vienna, Austria. Contact: IFIP Conference on Human Choice and Computers, Austrian Organizing Committee (Fred Margolies), P.O. Box 179, A-1013 Vienna, Austria.
17-23 June 1979	Workshop on Human Rights and Public Policy, St. Johns College, Annapolis, MD. Co-sponsored by the University of Maryland Center for Philosophy and Public Policy and The Hastings Center. Contact: Dr. Peter Brown, Director, Center for Philosophy and Public Policy, University of Maryland, College Park, MD 20742.
19-26 June 1979	Conference on Ethics and Scientific Responsibility, University of California-San Diego, San Diego, CA. Contact: Jeffrey Leifer, Political Science Department (B-023), University of California-San Diego, La Jolla, CA 92093.
24-29 June 1979	Ethical Issues in Human Reproduction Technology: Analysis by Women, sponsored by the Federation of Organizations for Professional Women, Hampshire College, Amherst, MA. Contact: EIRTAW, P.O. Box 1022, Amherst, MA 01002.
12-24 July 1979	World Council of Churches Conference on Faith, Science, and the Future, Massachusetts Institute of Technology, Cambridge, MA. Contact: Gordon Schultz, Room 26-147 M.I.T., Cambridge, MA 02139.
12-20 July 1979	World Conference on Agrarian Reform and Rural Development, Rome, Italy. Sponsored by the United Nations Food and Agricultural Organization (North American Liaison Office, 1776 F Street, N.W., Washington, DC 20437).

5 August 1979	Seminar on Innovations in Teaching Science Communication, held in conjunction with Association for Education in Journalism Annual Meeting, Houston, TX. Contact: Prof. Sharon Friedman, Journalism Div., UC #29, Lehigh University, Bethlehem, PA 18015.
19-26 August 1979	Fourth International Wittgenstein Symposium, Kirchberg/Wechsel, Austria. Theme: "Language, Logic, and Philosophy." Sponsor: The Austrian Wittgenstein Society, (A. Hubner, President) A-2880 Kirchberg/Wechsel, Markt 234, Austria. U.S. contact: W. Leinfellner, Department of Philosophy, University of Nebraska, Lincoln, NE 68588.
20-31 August 1979	United Nations Conference on Science and Technology for Development, Vienna, Austria.
14-16 September 1979	Seventh Annual Biennial Convention of the American Studies Association, University of Minnesota, Minneapolis, MN. Program Committee Chairman: John Howe, Program in American Studies, 225 Lind Hall, University of Minnesota, 207 Church St., SE, Minneapolis, MN 55108.
14-17 September 1979	Royal Institute of Philosophy Conference on Law and Philosophy, University of Lancaster, Lancaster, England. Contact: M.A. Stewart, Department of Philosophy, The University, Lancaster LA1 4YT, England.
25-27 October 1979	INTERFACE '79--Third Annual Humanities and Technology Conference, Marietta, GA. Conference Co-Directors: Drs. Roberta Gates and George Kennedy, Department of English and History, Southern Technical Institute, Marietta, GA 30060.
29-31 October 1979	Annual Conference of the Association for Computing Machinery, Plaza Hotel, Detroit, MI. Theme: "Advances of the 70's--Challenges of the 80's." Program Chairman: James L. Elshoff, Computer Science Department, General Motors Research Laboratories, Warren, MI 48090.
1-3 November 1979	Conference on Business and Professional Ethics, Western Michigan University, Kalamazoo, MI. Contact: Prof. Michael S. Pritchard, Department of Philosophy, Western Michigan University, Kalamazoo, MI 49008.
2-4 November 1979	Third Annual Meeting, Society for the Social Studies of Science, Washington, DC. Contact: Albert J. Teich, Graduate Program in Science, Technology and Public Policy, George Washington University, Washington, DC 20052.

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- -

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